

# FLIGHT

The  
AIRCRAFT ENGINEER  
AND AIRSHIPS

First AERONAUTICAL  
WEEKLY IN THE  
WORLD

Founded in 1909 by Stanley Spooner

DEVOTED TO THE INTERESTS,  
PRACTICE AND PROGRESS  
OF AVIATION

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## A Very Big Move

WORDS almost fail us when we attempt to praise the enterprise of the Air Ministry and the Post Office. The scheme for improving Empire air mails outlined by Sir Philip Sassoon has surpassed all expectations and all hopes. Everyone knew that a considerable speeding-up was coming, for Sir Eric Geddes had mentioned flying to Sydney in about seven days. More frequent services had also been foretold, and Imperial Airways on their own initiative have already taken the first useful steps in that direction. But such frequency as Sir Philip Sassoon suggests, notably four or five services to India every week, had seemed an ideal of the distant future. What was not foreseen was the proposal to send all first-class mail matter to Empire countries on the route by air. The idea has often occurred to the visionaries among us as a goal to be aimed at, and perhaps some day to be reached. That the Government should expect to make this ideal a fact in two years from now is enough to make a man rub his eyes and wonder if a fairy god-mother has appeared on earth again.

Yet even that does not complete the tale of presents which Lord Londonderry and Sir Kingsley Wood have crammed into our Christmas stockings. They expect and they hope—though, of course, they cannot yet be sure—that the postage for a half-ounce letter for any of the Empire countries on the routes will be “in the region of 1½d.” Ministers do not as a rule express hopes in Parliament unless they have good grounds for expecting them to be realised. We may take it that in about two years’ time half-ounce letters to those Empire countries will cost us no more than will letters by train and steamer. If all these hopes materialise we shall soon be sending letters to India as fast as, cheaper than, and almost as often as a few years ago we could send letters to Rome. The combination of speed, frequency, cheapness, and the invariable use of the air for letters is enough

to cause an indigestion of delight. Never before in the history of the world has such a transport scheme been even envisaged.

Night flying will be necessary on some sections of the route, and the need of setting up an elaborate system of lighting, wireless, and very complete meteorological services explains the delay of two years before the scheme can be put into full operation. Large orders will also have to be placed for new aircraft, for the existing fleet of Imperial Airways is already working to full capacity, and with not much margin in the way of relief machines. Excellent new designs will be needed, and we are sure that our designers will answer that call. Something like quantity production will also be needed. The machines will have to carry both passengers and mails, for Imperial Airways remain convinced that the combination of the two is the best policy.

### Passenger Comforts

Presuming that passengers actually are a very profitable form of cargo, economy demands that all seats on the machine must be filled, if possible. If sleeping bunks are substituted for seats, the capacity of the machine is reduced, which would suggest a loss. Taking the worst case, one can hardly imagine passengers for Australia sitting more or less upright for seven days and nights on end. Many will want to spend the nights on the ground, and if the sleeping berth plan is adopted several of them will be obliged to do so. The aeroplane will fly on, and those passengers will have to wait for the next one. If there are five services a week to India, they may catch a machine next day on that section. Between India and Singapore there will be only three services a week, so that a wait of one day, or perhaps two, on the ground will be necessary. From Singapore to Australia two services a week are proposed, so that a halt on that section might mean a wait of three or four days before the next aeroplane could be boarded. We shall need a daily service right through before passengers will be able to take full advantage of the increased

speed of the services. The alternative is to use separate passenger and mail machines and to send mails through to Australia, not in a week but in three days. That seems to us to be the ideal way of dealing with the problem, and we believe that it will remain the ideal way, even after the daily passenger service has been instituted.

For the moment, however, we prefer to gaze with pleasure on the grand new prospect opened out, rather than to dwell on possible drawbacks, and on points where the scheme falls short of the ideal. It is a great conception, and we offer our heartiest congratulations to the Air Ministry, to the Post Office, and to Imperial Airways.

## A Director-General of Civil Aviation

THE decision to raise the status of the head of the Civil Aviation Department of the Air Ministry by making him Director-General, instead of merely Director, should set at rest the anxieties of the parliamentary air committee. That active body has been much concerned about the statutory relations of the Air Council and the Director of Civil Aviation. These relations date from just after the Armistice. The War ended with Sir Frederick Sykes as Chief of the Air Staff and Sir Hugh (now Lord) Trenchard in command of the Independent Air Force. There had to be a reshuffling of posts, and Sir Hugh was made Chief of the Air Staff and entrusted with the formation of the new Royal Air Force, in which at the time no officer held a permanent commission. Sir Frederick was given the new and equally important task of forming and organising the whole fabric of civil flying under Air Ministry control. It would, of course, have been derogatory to an officer of his rank and services to have offered him a mere directorship, and so he was made Controller of Civil Aviation and a member of the Air Council. The Air Council was certainly made statutorily responsible for both military and civil flying, for it was not then fully foreseen how far those two branches would diverge in the next few years.

When Sir Frederick Sykes was succeeded by Sir Sefton Brancker the Controllorship of Civil Aviation was abolished, and a Directorship was substituted. The D.C.A. was not a member of the Air Council, but worked immediately under the Under-Secretary of State, who was charged by statute with the care of civil flying, and was given direct access to the Secretary of State whenever such contact was desired.

In effect, the statute which charged the Air Council with responsibility for civil flying became a dead letter, though the statute remained unaltered. It is a troublesome business to get a statute altered, especially when

## THE AIR MAIL PROPOSALS

*The proposed times for the journeys and the present times are as follows :—*

	To-day's Times Days.	Proposed Times Days.		To-day's Times Days.	Proposed Times Days.
India .....	6½	Just over 2	Singapore .....	8½	4
East Africa .....	6½	2½	Australia .....		
Capetown .....	9	4	(Brisbane) ...	12½	7

*The proposed number of journeys per week is :—*

India .....	4 or 5	South Africa .....	2
East Africa .....	3	Australia .....	2
Singapore .....	3		

*The proposed postal charge of "about 1½d." compares with the following :—*

	Per half-ounce. Rates up to November 17, 1934. d.	To-day's rates. s. d.		Per half-ounce. Rates up to November 17, 1934. d.	To-day's rates. s. d.
Egypt .....	3½	0 3	South Africa .....	10	0 6
Palestine .....	3½	0 3	India .....	8	0 6
Sudan .....	5	0 3	Malaya .....	11	0 6
Kenya .....	7	0 6	Australia .....	—	1 3
N. Rhodesia .....	9	0 6			

the time of parliament is so fully occupied as it is just now. In practice, however, the military and civil sides of the Air Ministry have worked as in water-tight compartments, and the Air Members of Council have shown no disposition to interfere with the civil side. It would not have been easy for them to do so if they had felt inclined, once the Director of Civil Aviation had persuaded the Under-

Secretary and the Secretary of State of the desirability of his proposals.

The idea of interference by the Air Council into civil flying may perhaps have arisen from a certain committee formed several years ago, on which Sir Hugh Trenchard (as he then was) had a seat. He wrote a minority report, in which he said that he was opposed to subsidies for commercial air lines. That report, however, did not prevent the Government from granting subsidies to the cross-Channel flying companies and, later, to Imperial Airways. A minority report by a member of a committee was not the same as action by the Air Council.

## Good Will in the Past

CONTACT between the two sides of the Air Ministry there certainly has been, and from that contact the civil side has, on the whole, gained. The opening up of the African Airway by the Middle East Command during the War, when there was no Department of Civil Aviation, and the operation of the Baghdad Air Mail by the same Command for several years before Imperial Airways were ready to take it over, are not, perhaps, cases in point.

Very much to the point was the active part played by No. 203 (Flying Boat) Squadron in surveying the route along the Arabian shore of the Persian Gulf when Imperial Airways found it necessary to abandon the Persian shore route. Had civil flying been the care of any department of State other than the Air Ministry we cannot feel sure that the Royal Air Force would have been so ready and willing to spend much time in surveying this route.

In fact, the working of the two branches of the Air Ministry in the past has been sufficiently satisfactory. The new dignity conferred upon the civil side will, however, mark its independence in a way which all may see, and therefore is to be welcomed. It is, moreover, a sound principle to put matters on such a footing that harmonious working does not depend on good will and tact between individual officials. It is best to guard against the possibility of some future lawyer-minded Chief of the Air Staff trying to exert a constitutional right to interfere with the civil side. It was an improbable possibility, but now even that possibility has been definitely removed.



# The Outlook

## A Running Commentary on Air Topics

### Wood or Metal?

IT is now some years since *Flight* first called attention to a growing tendency to revert to wood construction in small civil aeroplanes. We recalled that when the original Air Ministry stipulation concerning all-metal construction was made, the main reason was not the superiority of one material over another, but purely a question of obtaining adequate supplies of wood in time of war. It was also pointed out that silver spruce for wing spars was the material most likely to become scarce, and that there seemed to be no very logical reason for banning other woods for other structural work.

In his article in *The Aircraft Engineer* this week, Mr. H. J. Pollard examines the question of whether or not wood is really a satisfactory material from the structural point of view, and comes to the conclusion that it is less satisfactory than metal. We imagine that he may be challenged on certain of his contentions, apart from the reference to "factories ill-equipped for metal work." We have in mind the largest factory producing civil aeroplanes in this country. This is an entirely new one, and it is difficult to believe that it has been and is being equipped largely for wooden construction of aeroplanes merely because it is cheaper so to equip it. It would be interesting to have the views of readers on whether all-wood construction is really, as Mr. Pollard appears to believe, a retrograde step.

### The K.L.M. Tragedy

AMONG all the world air transport concerns none has done more to prove the reliability and safety of air travel than K.L.M., and the whole world will sympathise with them in the loss of their mail-carrying Douglas near Rutbah Wells.

It is doubly unfortunate that this ill-fated machine should, by reason of its amazing performance in the England-Australia race, have been made a symbol of everything that modern air travel should mean. The Press, in making front-page news of the "flying hotel," as they called K.L.M.'s Douglas D.C.2, have also been making the general public see just how comfortable, how fast, and how reliable a modern air liner can be.

Tragedies are inevitable in the development of a new form of transport, but this is a public rather than a private tragedy, coming just when great developments have been announced.

### Closed-in Fighters

COVERED cockpits for single-seater fighters are being experimented with, as Sir Philip Sassoon stated in the House of Commons the other day. A transparent cover over the pilot's cockpit would interfere less with the flow of air, and so would improve the performance of the machine. A still greater advantage might be the greater ease of keeping the pilot warm when flying at high altitudes.

One point, however, will have to be kept carefully in mind when designing such a cover, namely, that it should not in any way hamper the pilot if he needs to get out and come down by parachute. A complicated fixing of the hood might conceivably be jammed if hit by a bullet, and that might have disastrous results. One of the

greatest advantages of the parachute is that in war the pilot feels that he will not be trapped if his petrol tank is set on fire by enemy bullets. If the cover were not fool-proof in that respect, its disadvantages might be greater than its advantages.

### Bomber Classification

THE old Royal Air Force designation of "day bomber" and "night bomber" is to disappear, and instead all bomber squadrons are to be classified as "light," "medium," and "heavy," with an additional classification, "general purpose." For a long time past we have been accustomed to talking about "general purpose" types, but that applied to aircraft and not to squadrons. A "G.P." aeroplane was one which could be equipped either as a bomber or as an army co-operation machine, and could be served out to squadrons of either of those classes. The best-known G.P. machines were the "Wapiti" and the Fairey III F. In only one case did the *Air Force List* recognise the term "G.P.," namely, in the case of the Fairey III F's in possession of No. 8 (Bomber) Squadron at Aden, though the unit is definitely called a bomber squadron. It is soon to have the "Vincent," which is one of the latest G.P. types.

For the rest, the term "light" bombers will include the "Hart" and "Gordon," "medium" means at present the "Overstrand" and "Sidestrand," while "heavy" indicates such machines as the "Heyford" and "Hendon." The term "night bomber" has been rather a misnomer. The dark colour with which they are painted fits them specially for night work—even though they look dead white when caught in searchlight beams. In Air Exercises a few years ago the A.O.C. Wessex Bombing Area created something of a sensation by sending his "Virginias" by day up to what was called the Sealand Gap and bombing Yorkshire, to the great surprise of the A.O.C. Fighting Area. That showed the possible uses of the heavy bomber by day, and paved the way for the new classification.

### Aeroplanes and Cars

FAR too often a comparison is drawn between aeroplanes and motor cars. The assertion is made that in a few years the sky will be full of privately owned aeroplanes, buzzing in all directions and landing anywhere and everywhere. Actually, there is little or no analogy between the two; it would be more truthful to say there is likely to be a slight similarity between the growth of shipping and that of aircraft. An aeroplane pilot, if he is to be a safe one, has to take into account the weather, wind direction, and many other factors, in just the same way as does the owner of a yacht.

It is, to say the least of it, highly unlikely that aeroplanes can ever become the vehicles of the multitude until a means is found of eradicating this dependence on a knowledge of navigation. The public are daily coming to look upon flying as an ordinary thing, and soon they will patronise air liners with the same readiness with which they patronise ships; but the widespread use of light aeroplanes will probably be left to the expert amateur for many years to come.



# BRINGING

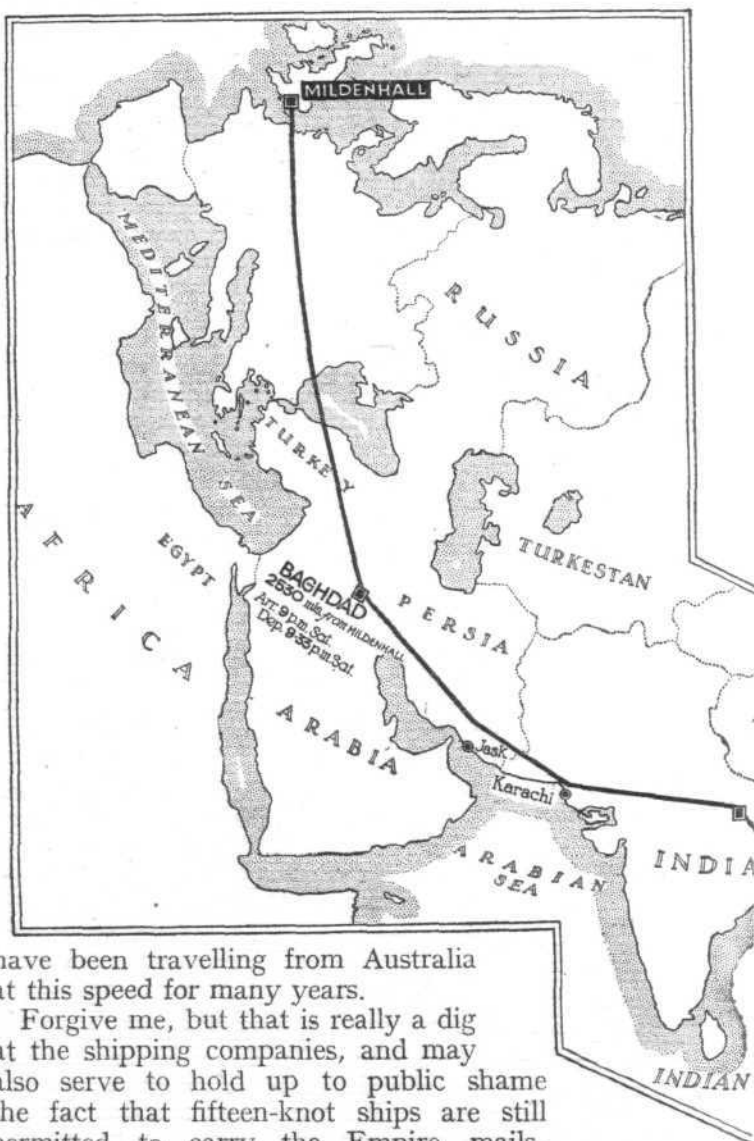
*The Melbourne Race  
Discusses the Future of  
Australian Air Travel*

(Left) Scott and Black  
in their D.H. "Comet."

THE Melbourne Air Race has been flown and won. That remark is meant neither as a platitude nor as a hoisting of one's own colours. It is merely the statement of an established fact. But the mere statement of fact is not sufficient to dispose of such an event. History and the Press have made more of it, and because this is so one cannot so easily escape from it.

At a luncheon the other day I spoke rather plaintively to a very responsible gentleman sitting beside me. I asked him and informed him (for my statement was both a plaint and a query), "Is it fair, sir, do you think, that people should regard one as having assumed the mantle of a disciple simply because one happens in one's professional capacity of pilot to have been partly responsible for the winning of the Melbourne Centenary Air Race?" He laughed and agreed with me that it wasn't. But the fact still remains that gracious people even now imagine that because one was part of the crew of the winning machine, a special deity has suddenly gifted one with the power to dictate policies to governments, influence private minds (actually a far harder thing), and generally influence Empire air routes in a direction in which we all know they should go (though none of us is quite sure how a start could be made).

At the moment of writing (and, tell it not in Gath, the moment is four in the morning of the day this has to be in the printer's hands) the great line of Imperial Airways has two machines speeding across the world. The first Australian air mail—that is, the first continuous and recognised air mail, Australia having done it before—will be in Australia by Christmas-time, perhaps to recompense the Australians for the gifts of baby lamb they so kindly send annually to these shores by the medium of the shipping lines. It takes well over a month to send a baby lamb from Australia to England by sea, and about a fortnight to send a letter to Australia by air mail. In spite of the longer time, the lamb will often arrive in much better condition than the air mail. But this is probably the result of much practice, for baby lambs



have been travelling from Australia at this speed for many years.

Forgive me, but that is really a dig at the shipping companies, and may also serve to hold up to public shame the fact that fifteen-knot ships are still permitted to carry the Empire mails. Were these shipping companies to operate thirty-knot ships it would seem (unless my mathematics are at fault, and this may well be so at this time in the morning) their schedule would be nearer a fortnight, much the same as that of Imperial Airways, who are operating, we are told, at a mean speed of over one hundred miles per hour. There seems to be something radically wrong somewhere!

Of course, ships have a happy knack of carrying on during the hours of darkness, while aeroplanes have to be snugly tied and picketed almost the minute the sun sets, although on exceptional occasions such as inaugural services they are occasionally flown in the dark a little before dawn.



# AUSTRALIA NEARER

By C.W.A. SCOTT

winner in this Special Article for "Flight" of Air Transport between England and Lessons Which the Race Taught

To allow for these night stops on long-distance routes (and in case anyone thinks I am poking fun at them, I hasten to say I thoroughly agree with the idea) aeroplane cruising speeds should be a little greater. Is this a fair plaint? Am I echoing popular and public opinion?

Given higher cruising speeds, the aeroplanes could well be allowed their rests on the ground. Under present conditions, with the modest cruising speeds prevailing, real success in long-distance mail operation would have to depend on a flying schedule that takes in the whole twenty-two hours of the day (going eastward) or the whole twenty-six hours (coming westward).

Of course, I am in the happy position of claiming that in the Melbourne Race we flew continuously through the night and day. In extenuation of such bravery one must in all fairness point out (otherwise it would be pointed out for me) that the race was flown in between the monsoons; that the weather generally was good at that time of year; that at other times of the year there is very bad weather along the route; and that the aerodromes are sometimes in very bad condition.

But, of course, we carried no wireless, and the route, after all these years, is still far from perfect. Actually, too, we *did* have some very bad weather at times, as our friends from Holland will testify.

How, then, can this route be speeded up?

For a speeding-up is essential if we are to maintain an aircraft prestige

against the shipping companies, who *might* suddenly take it into their heads to operate thirty-knot steamships that would do their journey to Australia in fourteen or so days?

The obvious retort, of course, is "By higher cruising speeds in the aeroplanes too." If our aircraft speeds could suddenly be accelerated by one hundred per cent., the pilots and machines could still get their rest and the schedule could be cut by half.

But to reduce the schedule under the existing conditions of aircraft, the route must be improved; not geographically, of course, for we have not yet altered the face of the earth to this extent, but by the installation of radio beacons, meteorological services, runways on the aerodromes, and so forth.

This will cost, as an initial figure, and not, of course, counting maintenance, somewhere in the region of a quarter to half a million pounds.

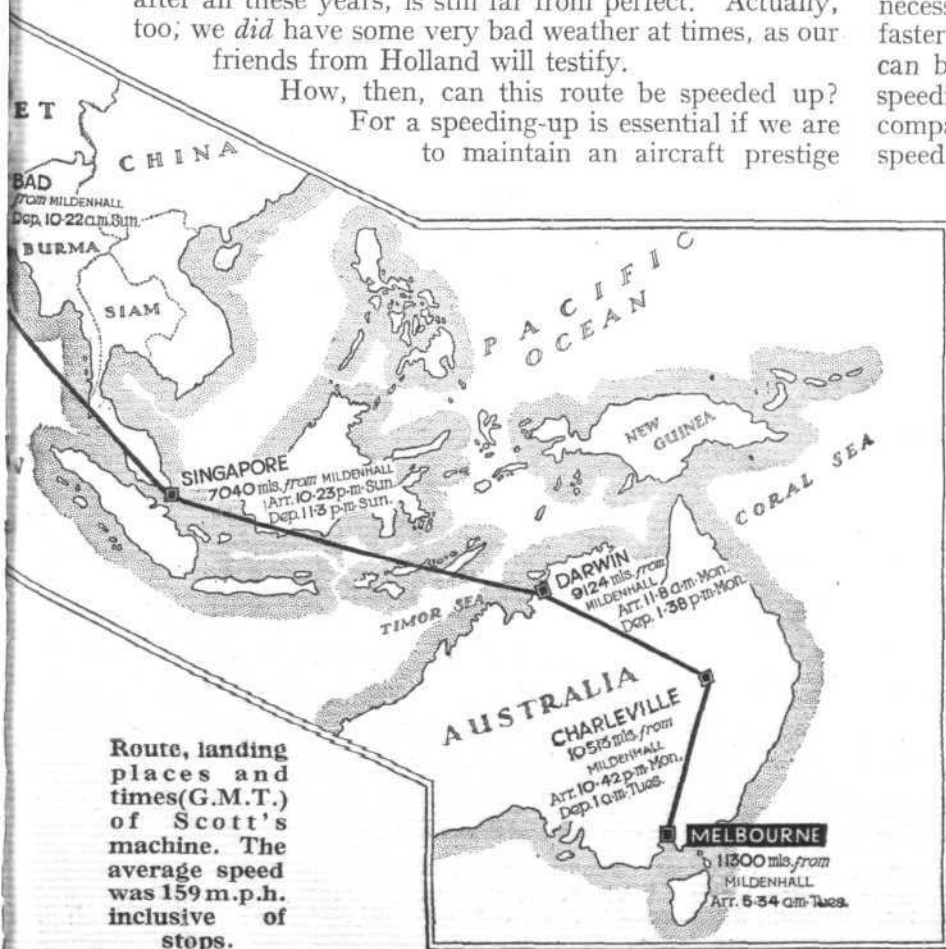
That is the other side of the equation. If faster aeroplanes were to be used, perhaps the route would not have to be so drastically improved at such a price—one that civil aviation can scarcely stand. *But*—even if the route were so drastically altered, would the same aeroplanes operate at *very* much quicker schedules? I doubt it.

It appears to me, therefore, that a compromise is necessary—a combination of an improved route and faster aeroplanes is essential before the Australian route can be speeded-up. In other words, the onus of such speeding-up must be borne jointly between the operating companies themselves (with the purchase of higher-speed aircraft) and civil aviation organisers in their capacity of route caretakers.

With regard to the technical aspects of future services between England and Australia, the race has, to my mind, proved that controllable-pitch airscrews and retractable undercarriages are absolute necessities, while there is no question that pilots on such a service must be thoroughly capable of flying by their instruments; we ourselves got the greatest help from the Sperry artificial horizon.

I certainly think that before long we shall see the mail flown regularly in small, very fast aeroplanes, while passengers are carried in somewhat slower, but very much larger and more comfortable machines. I do not think that there is a likelihood of freight services proving successful, as the main exports from Australia are wheat, wool, butter and meat, all Australia are bulky commodities.

I know the Australian people rather well, and possibly understand better than many people here in England what the aeroplane can do for Australia. Moreover, the Australian people themselves realise that their isolation from the Mother Country can be reduced almost to zero by the use of high-speed commercial aeroplanes.



# THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

## Mr. Campbell Black Engaged

The engagement was announced last week of Mr. T. Campbell Black—co-winner with Mr. C. W. A. Scott, of the England-Australia Air Race—to Miss Florence Desmond, the actress.

## Wright Brothers' Celebrations

Celebrating the Wright Brothers' first flight of December 17, 1903, some seven thousand aeroplanes took part in air pageants in various parts of the United States last week.

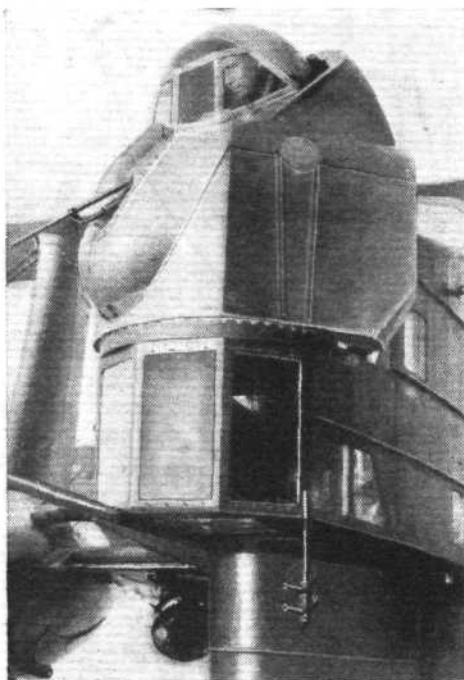
## Was it Ulm's?

A report from Honolulu states that pieces of wood resembling parts of an aeroplane have been found off Niihau Island, north-west of the Hawaii group. It is thought that these might be part of Mr. C. T. P. Ulm's machine, which was forced down in the Pacific on December 4. Since they came down there has been no further news of Mr. Ulm and his companions. Mrs. Ulm has chartered a motor vessel which will carry out a thorough search around the islands.

## Twenty-five Years Ago

From "Flight" of December 25, 1909.

"... On the same day (December 15) Paulhan made a noteworthy performance. Although a gusty wind was blowing he determined to try a new Henry Farman machine in which poplar has been used instead of ash, so saving weight. The machine is also smaller than the usual type, but despite this he carried two passengers weighing together 330 lb., and also took 10 gallons of petrol. He would thus appear to have beaten all records as regards weight-lifting."



**TURRETED:** The forward gunner of the big French Liore et Olivier 208 bomber is protected from a 200 m.p.h. air-stream by this ingenious turret, which turns both in horizontal and vertical planes.

## The Modern Boy

Discarding old-fashioned methods of travel, boys of King William's College, Isle of Man, chartered an aeroplane to fly home to Liverpool for the holidays.

## Dutch Airmen Visit London

Messrs. Parmentier and Moll, pilots of the Douglas air liner which took second place in the Melbourne air race, arrived at Croydon on Tuesday of last week from Holland to attend dinners given in connection with the race.

## The Zucker Rocket Again

A further attempt to transport mail by rocket by Herr Gerhard Zucker ended in failure on Wednesday of last week. This time it was hoped to fire the rocket, with 600 letters, from Lymington, Hants, to the Isle of Wight, but the pyrotechnic postman decided to go to Pennington—about one mile westward—instead.

## Belgian Avros

Capt. Nyssens, of the Belgian Air Force—who is the son of Maj.-Gen. Nyssens, Military and Air Attaché to the Belgian Embassy in London—arrived in England from Brussels last week on his way to Manchester to take delivery of some Avro machines for the Belgian Air Force.

## "Graf Zeppelin's" Million

While returning from its Christmas cruise to South America last week the crew of the *Graf Zeppelin* received a broadcast message from Gen. Göring congratulating them on the airship's passing the millionth kilometre it has flown since it was launched in 1928.

## From Cowpuncher to Test Pilot

Eight years of test flying Boeing planes, including everything from tiny pursuits to large multi-motored transports, have been completed by Les Tower, of the Boeing Aircraft Company, Seattle. Once a cowpuncher in Montana, Tower joined the Boeing Company as draftsman in 1925 after completing an engineering course at the University of Washington. He gained flying experience with the Army Air Corps at Langley Field, Virginia, and started test flying Boeing planes in 1926. Since then he has taken up virtually every new-type commercial and military craft coming from the plant. It is something of a tribute to both the machines and his flying that he has never "gone over the side."

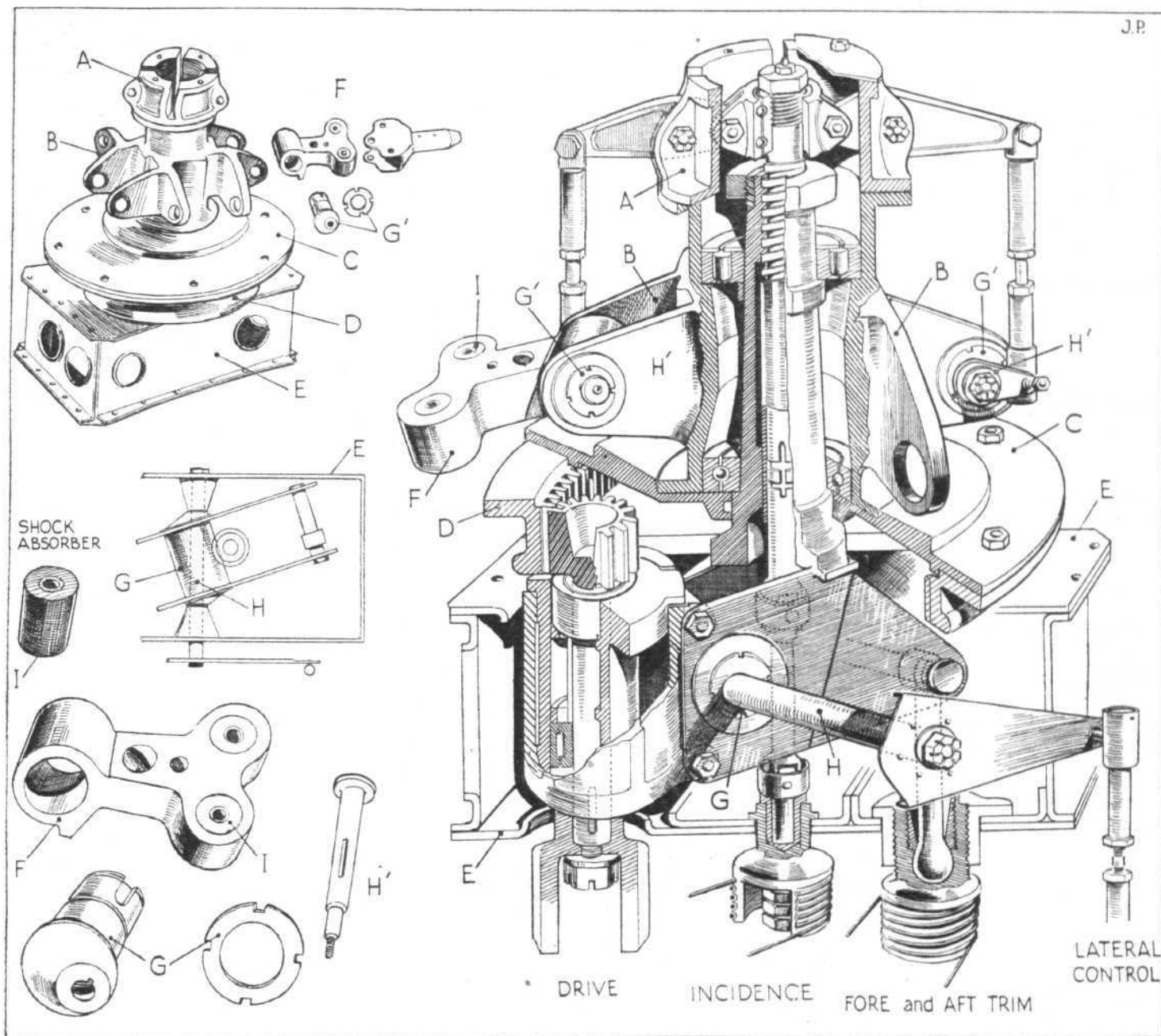


**MAILS TO THE CONGO:** The modified (and renamed) "Comet" ready for Mr. Ken Waller and M. Franchomme to carry the Christmas mails to the Congo. With the rear tank removed and with a mail compartment and a smaller tank in the nose, the machine still has a safe range of 2,000 miles carrying 200-250 lbs. of mail matter. The "Reine Astrid" left Brussels last Thursday.



# A VARIABLE-INCIDENCE GYROPLANE

*Preliminary Details of the Kay Gyroplane: Incidence of the Blades Variable at the Will of the Pilot*



This "skeleton" drawing illustrates the essential features of the head of the Kay Gyroplane. The small plan on the left shows how the rotation of the "Z" crank G imparts a lateral motion to the whole of the head, while the change of incidence for the blade is produced in the same manner with the "Z" cranks G'.

**I**N the wilds of Scotland, Mr. David Kay and his friend, Mr. John Grieve, have for some years been experimenting with a rotary-winged aircraft incorporating an ingenious system for varying the incidence of the blades. A prototype was built at Perth and tested with quite a considerable amount of flying, not only by the inventor, but also by an Air Ministry official. The results obtained were so promising, and the interest shown in the machine so great, that it was decided to produce some improved machines, and the first of these is now practically ready for test flights at Southampton Airport.

Structurally, the fuselage is a fairly straightforward welded steel-tube body with a conventional widespread undercarriage and an engine mounting in the front carrying a Pobjoy "R" engine working a four-bladed airscrew.

The pylon carrying the rotor head above the fuselage is of steel tubes, and is particularly rigid, as, before taking off, the rotor has to be speeded-up to about 400 r.p.m.

This speeding-up is done by a straightforward power transmission layout from the rear of the engine via a Ferodo-faced cone clutch and bevel gearing to a shaft terminating in a vertically toothed pinion driving on the internal teeth of a ring encircling the head. This pinion is mounted eccentrically, so that it is thrown out of gear when the head over-runs the drive. In this position the head is free to rotate and the autogyrotary process starts.

Four blades of fairly normal construction with tapered-gauge steel tube spars, wooden ribs and plywood covering are connected by links to the rotating portion of the head. This portion is mounted on a transverse "Z" crank, the

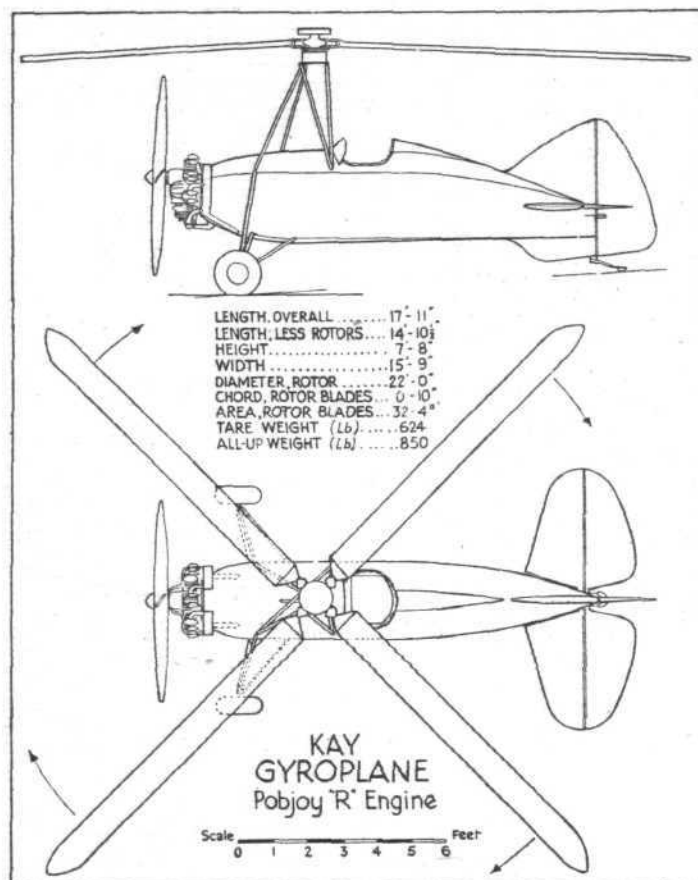
oscillation of which produces a lateral rocking motion of the head, and therefore of the complete rotor system. This motion is not at right angles to the centre line of the machine, so that a small pitching moment is involved, and this moment serves to counteract any tendency to climb or dive during turns.

A "spectacle" form of control wheel operates this "Z" crank for lateral control purposes. Fore and aft control is secured by a pull-and-push motion of this wheel, operating normal elevators, while direction is controlled by pedals and a rudder. Fore-and-aft trim is secured by a wheel-operated screw which gives a permanent tilt to the head.

The incidence of the four blades is varied by mounting each link which secures the blade itself to the head on individual "Z" cranks. A screwed shaft runs right up through the head, operating small cranks and levers to each blade link for the rotation of these "Z" cranks. The hand control of this variable-incidence system has various safety connections which ensures that the rotor can only be run up with the blades set in the position of no lift.

Briefly, the operation of the Kay Gyroplane is as follows: The rotor is run up to about 400 r.p.m. with the blades set at negative incidence, and the drive mechanism is then released. At the same time the incidence of the blades is increased to a positive degree, when it is found that the momentum of the blades, which promptly slow down to about 230 r.p.m., serves to lift the machine from the ground. Releasing the drive, of course, transfers the whole output of the engine to the tractor airscrew, and as the machine moves forward the autogyration continues, resulting in a steady climb according to the amount of control used.

A great asset of this system will probably be found when high-speed tests are made, as the accentuated coning angle which the blades take up when their incidence is high is naturally a serious drag-producing factor. With the Kay Gyroplane the incidence can be reduced at operational height so that the coning angle is reduced and therefore the drag, and the speed is increased. Thus it would seem that this machine embodies the same effects as a slotted, flapped, variable-area and variable-incidence fixed-wing aircraft. A further point of value in the variable incidence is the braking effect which can be



General arrangement drawings of the Kay Gyroplane in experimental and not production form.

secured at the moment of landing by an increase in incidence, so that extremely gentle landings can be made. Finally, setting the incidence at a negative value immediately on landing precludes any possibility of the machine blowing over in gusty winds.

There are, of course, many other points of great interest in this machine, with which we hope to deal after flying trials have been made.

## BUILT TO AN IDEAL

*The Aero Research "Snark." High Gross-Tare Weight Ratio.*

TO the design of Dr. N. A. de Bruyne, Aero Research, Ltd., of The Aerodrome, Newmarket Road, Cambridge, has constructed an interesting wooden cantilever monoplane to seat four persons. Powered with a "Gipsy Major" engine of 130 h.p., the aircraft was flown last week for the first time by its designer, who reports that it handled well and landed at a very low speed. Bad visibility made it impossible to obtain accurate data, but the top speed appeared to be about 120 m.p.h.

The "Snark," to give the machine its name of somewhat cryptic derivation, was designed for the personal use of Dr. de Bruyne, who required an economical low-wing cantilever monoplane with folding wings in which a low wing-loading was reconciled to a good ratio of gross to tare weight. After three years of research the company believes that these requirements have duly been met, as the tare weight of the "Snark" is 1,180lb., and the gross weight (which may be increased later without alteration in structure weight) is 2,200lb. This gives a wing loading, based on full load, of 9.6lb./sq. ft.

Although apparently conventional in design, the wing, which is covered with plywood, is believed by the designer to be the first of its type to have been stressed analytically. Within the wing, the trailing edges of which are swept forward, are luggage compartments, situated over the C.G. of the machine, and further out-

board are tanks for thirty-two gallons of petrol. Thus, it is claimed, the loads are well distributed. The pilot and one passenger sit over the front spar, and the remaining two passengers are seated over the rear spar. Differential ailerons are fitted, with their operating mechanism (which embodies neither cranks nor chains) enclosed within the wing. The *empennage* is of cantilever construction.

A very large amount of work has been done by the company on the stressing of plywood-covered fuselages, one of which is employed for the "Snark." Another example, incidentally, has been purchased by the Air Ministry and has passed all its tests satisfactorily.

Dual controls are fitted, embodying duplicated rudder pedals and a central control column incorporating a "flop over" device. The elevator control wires run straight from the control column to the elevators, and are entirely enclosed within the fuselage. It is possible to remove the front flooring of the cockpit to expose the control mechanism, and there is a large inspection opening behind the rear spar.

Each half of the nine-foot-wide undercarriage, which is of the company's own construction, has but one moving part. Brakes are fitted, and are operated by a centrally mounted column. When the brakes are "on" the elevators are automatically locked in the "up" position.

(A photograph of the machine appears on page 1386.)



# THE GATEWAY *to the* EAST

## Part IV.—*The Airport and City of Baghdad : the Return Flight to England*

By C. N. COLSON

BAGHDAD aerodrome lies west of the city and is a credit to those responsible for its establishment. It is in an extremely important position—one, in fact, which may be called a key position in our system of Empire air routes. Under the original direction of Mr. Gumbley, it was laid out admirably with very modern equipment, night landing facilities, a "shadow-bar" floodlight, and a well-planned, imposing administrative building. The landing area is now large enough to give 2,000-yd. runways, and, like those of most desert aerodromes, the approaches are entirely unobstructed.

The England-Australia Race has drawn attention to a fact which has long been obvious to everyone connected with the expansion of our air system—namely, that Baghdad lies on the shortest practical course between England and our possessions further east, such as India and Australia. The Iraqi Government is therefore to be congratulated not only on carrying through Mr. Gumbley's plan for the airport but also for the helpful attitude which it adopted during the Race, and the way in which it backed up Mr. Bailey, who, now that Mr. Gumbley has retired, is in charge of civil aviation.

Returning to matters which directly affected our flight, pilots arriving in Iraq must be careful to see that they have a Bill of Health showing that there is no serious epidemic in the place they last left. The authorities view the risk of cholera and similar illnesses extremely seriously, and failure to produce the necessary Bill of Health will mean considerable delay. As in other eastern countries, it is useless trying to hurry the officials unduly, and diplomacy is the method to employ if you want to get your passports, Customs clearance, and so on put through quickly. Our leaving, on the Monday following the Race, was considerably delayed by our omission to give the authorities twelve hours' notice of our intended departure; visiting pilots will do well to remember this.

Charges at the aerodrome are fairly reasonable; our bill for landing fees and housing for five nights was a little over £4. One point which struck us was the placing of the main airport building so that all the dust thrown up by aeroplanes landing and taking off is blown towards it by the westerly wind, which, we were told, is the prevailing one. Probably questions such as that of possible flooding dictated this placing, although a bund has been built right round the aerodrome so that it should be immune in this respect.

Baghdad itself is fascinating to those who take sufficient interest in the East to look deeper than the inevitable dust and other annoyances, like flies or even more virulent insects. The glory of its former days has departed, but the spirit still remains and is to be found in unexpected corners by those who seek it. The almost prim orderliness of the Egyptians in Cairo and Alexandria does not exist. You see, instead, little evidence of wealth, a far greater variety of dress and head coverings, unmade roads, ramshackle shops with cheap American and Japanese goods, a struggling mass of humanity with widely differing racial characteristics, and only very little attempt at control and



A busy market street in Tunis.

regulation. Those who come into contact with the educated Iraqi find a lot to be admired. They are widely read, with a grasp of world affairs that is surprising, and a very strong pro-British feeling, although this last quality seems to be mainly confined to the younger generation; among the older men there are many who feel very differently.

Our return journey varied from our outward one in several places, and I shall confine this article to dealing with the various differences.

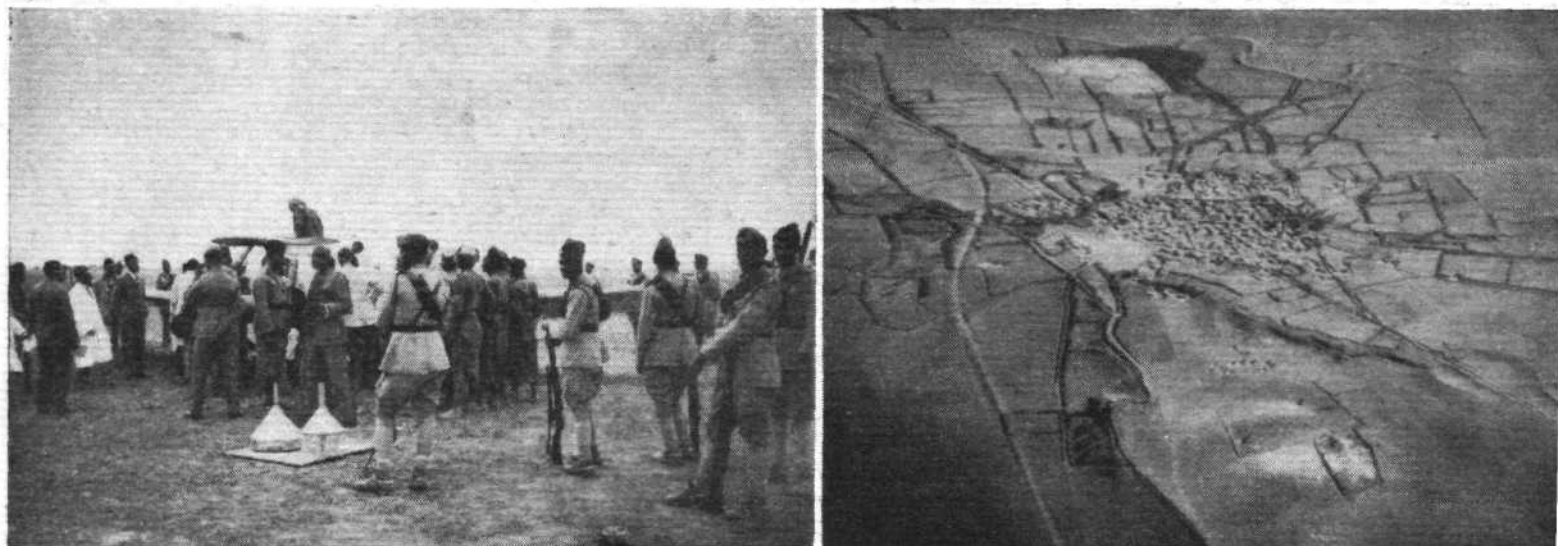
We left Baghdad early in the morning, although not as early as had been intended, because of the delay caused by our not having informed the authorities beforehand. When we arrived no one told us that this was necessary, so we felt somewhat wrathful at the delay, which meant that we should not be able to reach Cairo that night.

Between Baghdad and Rutbah Wells and then on to Amman we covered the same route as the outward journey, and were once again rather overcome by the desolation over which we had to fly for hours. We refuelled at Amman as

quickly as we could, still in the hope that we might have miscalculated the time of sunset, and that we might, therefore, be able to reach Cairo, but a head wind over the Jordan Valley finally decided the matter for us, and by the time we reached Gaza it was obvious that we should have to stay there for the night.

Gaza is a large, open desert aerodrome operated by Imperial Airways and the Air Ministry, and fees of 12s. 6d. for landing and 12s. 6d. for housing are charged. In addition, Imperial Airways charge another 5s. for handling the machine. The company also runs the rest house for the benefit of their own passengers and for people like ourselves

*This is the concluding instalment of Lieut.-Com.Colson's description of the journey which he made on behalf of "Flight" to investigate the conditions that the pilot is likely to encounter; in his next article he will set out his general conclusions.*



These photographs show, left to right: Soldiers of the Iraq Army guarding McGregor's "Hawk" (which finished Frenchman who had driven a motor cycle and sidecar hundreds of miles across

They admittedly give very good service, but 11s. 6d. each for a small double room, with 3s. 6d. for breakfast and 7s. 6d. for dinner, is a somewhat high bill to have to pay for one night in the desert. However, we had no choice about the matter, and it was pleasing to have a clean, comfortable place, with excellently served meals.

Leaving Gaza early next morning, we made the trip to Almaza Aerodrome in just over two hours. Although we had to get back to England by November 1, we felt justified in spending the rest of the day in Cairo so that the members of our crew who had never been there before could see what it was like. First of all, accompanied by Mrs. Stanley Leigh, wife of the manager of the Socony Vacuum Company, we made a circuit of Cairo, while Mrs. Leigh very kindly pointed out the chief points of interest. After landing we visited the Museum to have a look at the magnificent finds made in the tomb of Tutankhamen, and then spent the rest of the day in visiting the Citadel and other places of interest. In the evening we had the pleasure of entertaining Sir Quintin Brand, Director General of Civil Aviation in Egypt, who was able to tell us all about the extensive development work going on under his direction.

Next morning we again flew via Mersa Matruh and Tobruch to Bengasi, where we had to stay the night. Bengasi is one of the places on the North African coast which the Italian Government is doing its best to develop as fashionable watering-places, and under the guidance of the British Vice Consul, Mr. Ellul, we had a look at the wonderful promenade, the harbour, and some of the newer wide streets which are being laid out.

### Sirte to Tripoli

Leaving Bengasi early next day, we again went straight across the Bay to Sirte, where our wireless operator friend once more received us enthusiastically. We had to disappoint him on this occasion, because we were determined to reach Tunis that night if possible. After a quick refueling we were soon on our way again, and a comfortable, uneventful flight of just over two hours got us to Tripoli. We had to run through several rainstorms on the way, and at one time it really looked as if the clouds were going to close right down on us, but, luckily, it did not get any worse, and eventually we got through without any undue trouble.

When we reached Tripoli the weather cleared up, and we were welcomed by the Commandant, a very cheerful and helpful Italian officer, who had had the enviable experience of flying to New York and back with Air Marshal Balbo. I think the Italian officers were quite disappointed when we said that we could not stay to lunch, as they had been looking forward to meeting us again and having

a "party," but we had to spend a day in Rome on the way back, which allowed us very little time to lose if we were going to keep up to our schedule and arrive in England by November 1.

From Tripoli we flew straight across the sea some little way north of the Kerkena Islands to the coast south of Tunis. When we approached the coast the weather got really bad, and our chance of getting through before night-fall looked rather slim. However, we pushed on through the rain and low cloud, although, unfortunately, it meant that we had to go round the mountains which lie a little way South of Tunis, instead of going direct over them as we wanted to. When we got round the other side the weather was a little better, and we were able to appreciate that we had at last left desert country and could feast our eyes on green fields and low shrubs. Except for date palms there didn't appear to be very much in the way of trees about, but, nevertheless, it was a great relief to see green things again. Tunis aerodrome lies a good long way from the town, and is on the north-west side of the Bay. Actually, I believe it is nearer Carthage than Tunis.

### Ruins of Carthage

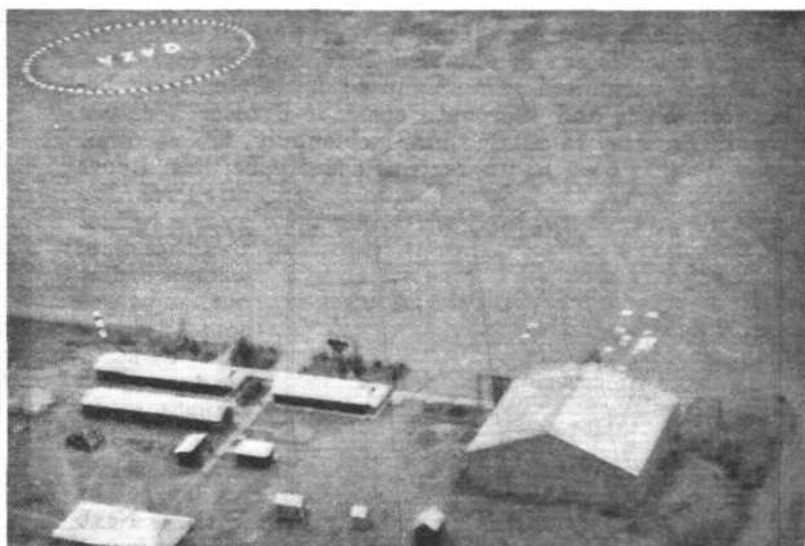
As there was still about an hour of daylight we thought this was a good opportunity to see something of this historical place, and so the Shell manager very kindly lent us his car to take us out to an hotel, where we had tea before going round the ruins. Back in Tunis at the Majestic Hotel, we accepted the offer of the Shell Company to let one of their representatives show us round the city on the following morning before leaving for Cagliari in Sardinia.

Tunis is an extremely interesting city, particularly for those who like to study the difference between English, Italian, and French control in Africa. We were told that times had been very hard indeed for the inhabitants, because, as in Cairo, tourists are one of their staple "trades," and for the last two or three years there has been very little touring.

Tunis is French territory, and so the charges were the same as other aerodromes in France, namely, 14.40 fr. for landing, 6.0 fr. for housing, and 3.90 fr. for Customs clearance. The aerodrome is fairly large, with a good hangar wherein are the aeroplanes of the flourishing local flying club. As we were leaving here for Italian territory it was necessary to have our cameras sealed again, for which the French aerodrome authorities charged us 3 fr. each!

Having satisfied ourselves that it was practicable to fly fairly long distances across the water, we decided to get to Rome by making Cagliari the next night, and then





in the Melbourne Race handicap) while refuelling at Baghdad; A desert village in Palestine; Arab interest in a desert from Damascus; and Gaza, with Imperial Airways rest house, from the air.

going on to Rome the following morning. The alternative would have meant going right round the Italian coast after crossing to Sicily—a very much longer trip, which would have cut short the time we had allowed ourselves in Rome.

Our flight across to Sardinia was peaceful and quite without incident. North of Tunis there is a prohibited area, which is annoying, as it necessitates a long westerly divergence from the direct route across to the island. There are some small islands a few miles north of the African coast, which gave us a good check for our drift, and enabled me to give Morton the course which brought us without alteration straight into Cagliari.

The aerodrome at Cagliari is large and very military. The Italian officers and men were all interested, and examined our "Dragon" from bow to stern, paying particular attention to the P.B. automatic pilot. They photographed the machine from various angles, and took down full details of the performance. We were told it was for official records, but why didn't they write to D.H.'s or read *Flight* if they wanted to know all about a "Dragon"? It would have been so much easier.

Cagliari has one of the largest hangars I have ever seen. The amount of money being spent on the development of the aerodrome must be colossal; there are extensive power houses and barracks, and they told us that it was going to be one of the most important aerodromes outside Rome. In spite of this blatant militarism they were all very helpful, and assisted us in every way they could, especially with the repair of a puncture in the tail wheel.

It is a long drive into Cagliari town, and after we had finished refuelling we had a "rattling" lift sitting on the petrol tins of the Shell lorry. We stayed at the Hotel Moderno, as that had been recommended to us by the Officer of the Day at the aerodrome. The food was good, and, except for the noise of traffic outside, we were quite comfortable.

### A Hectic Ride

Next morning we had the most terrifying ride any of us had ever had. Our taxi driver was brimming over with good spirits and garlic, and obviously jubilant at getting the job of taking six Englishmen and their luggage. How we all got into his ramshackle car is a mystery, but how we survived that ride is a greater mystery. Our garlic-surrounded driver kept his foot down hard the whole way, and constantly let go the wheel to point to the speedometer. Thank heavens, everyone else on the road seemed to enjoy the joke, and helped by getting out of our way!

We had to pay the same aerodrome charges as at Pisa: 28 lire for landing, 28 for housing, and 28 for taking-off.

Once more we had bother with getting weather reports until after 9 a.m., and when we got one from Rome we had to wait, because there it was thick fog. Eventually we got away at 10.30, and reached Rome in a little under three hours. We had to go up the Sardinian coast some way, because the whole area north of the town is prohibited, and, after striking out across the water, the flight over the sea was uneventful.

Rome lies well inland on a plain, so the fog was still hanging about, making it difficult to see the city, and we began to think that our lack of a drift sight had led us astray. However, it was all right, and dead on our E.T.A. we arrived over Littorio Aerodrome.

In Rome again we were most kindly looked after by Messrs. Vetta and Scriabine, who showed us the seaplane port of Ostia, where the pilots of Ala Littoria land the Savoia S.66 flying boats in a narrow stretch of the Tiber, and where the extremely modern commercial airport has been built. We also visited many of the historical buildings, and wished that we could stay for a week or more. The next day was October 28, the anniversary of the entry of Fascists into Rome. Mussolini was celebrating it by inaugurating the combining of all the Italian airline companies into one concern called Ala Littoria, and also by opening numerous roads and buildings. We heard that he inspected our "Dragon," and showed interest in its comfortable upholstery.

### To France Again

The next stage home was a flight straight across the Mediterranean, over the islands south of Elba, Monte Cristo, the northern end of Corsica, to Cannes. After paying 13.90 lire each for landing, taking-off, and housing, we got a fair weather report, and took off from Littorio. As it turned out, the weather wasn't very grand, and after Corsica we had to fly above or in the clouds for a great part of the time. However, despite numerous alterations of course when I decided that the wind had changed, we arrived, and by 3.20 p.m. had landed and were having a drink with M. Millet, the genial secretary of the local flying club which runs the aerodrome.

The landing area is not very large, and, to our "desert-acclimatised" eyes it did not look inviting, but Morton had been there before and landed without any difficulty. We spent the night in the Hotel Georges V. It was excellent, quiet, cheap, and good.

Next morning we had to fly to Marseilles round the coast, as the fog was thick over the mountains. When we arrived it was thicker than ever, and we had to while away the rest of the day watching French Air Force pupils landing high-speed fighters—a thrilling sight!

The final part of our trip covered more or less the same

ground as we had passed over on our way out. We got away from Marseilles next morning and landed at Lyons.

Lyons is a fine airport with very modern buildings. Excellent meals can be obtained there, and the aerodrome is a well patronised stopping place for those flying between Paris and the south coast of France. Weather reports are easy to obtain, and, incidentally, are essential, as there is a very bad stretch of country between Lyons

and Paris. We were luckier this time than when we flew out, and three hours' flying—we had a head wind—brought us to Le Bourget.

That night we spent in Paris. Next day we found the weather



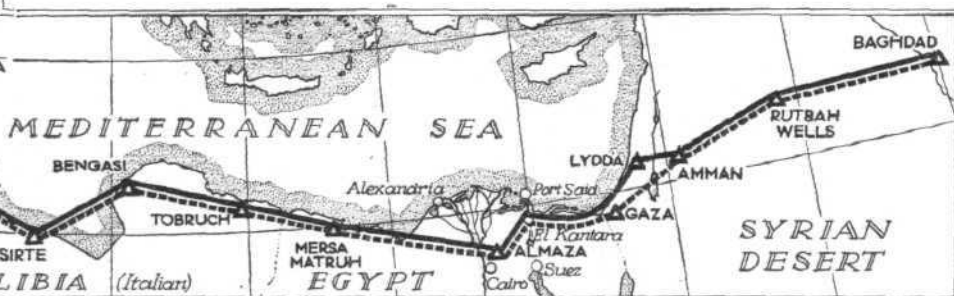
"OR" ready to leave Baghdad.

was very bad indeed, with low clouds right down on the ground, and we were not able to get farther than Berck, so once again we stayed at the Hotel Terrasse.

It cleared up the next morning, and a quick flight to Croydon ended our voyage. There the "Dragon" was returned to the care of Rollason's, and, despite the amount of hard work it had done, we learnt subsequently that very little indeed wanted attention.



The outward and homeward routes taken by the "Dragon."



## CORRESPONDENCE

The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.

### WIRELESS

[2986] While in America recently I was shown a report on aviation radio in Europe, written by an American after a visit to this continent. He wrote (in 1931):—

"It is particularly interesting to note that no attempt has been made to shield the motor ignition system or to properly bond the aircraft. The installation system and equipment are quite amateurish as compared to the average American installation."

To which he might now add that we in Europe have been guilty of putting pleasure before business, by virtually monopolising the medium long waves for purposes of broadcast entertainment, and that we are quite capable of repeating that blunder when the European frequency allocations for television are decided.

It is evident to all who have any knowledge of the present position that a determined effort must be made to obtain clear channels for future aeronautical requirements, and that these are now only to be found in the short wave bands. But in order to utilise these, efficient bonding and engine screening will be mandatory. The latter, however, will be more costly (and also less satisfactory) if it is left for the purchaser to install as an afterthought. Without going so far as to suggest that every commercial aircraft should be sold fully screened, I would certainly invite purchasers not only to bear in mind that in a year or two they will almost certainly require this, and may therefore do well to have it at once, but also to satisfy themselves that in all future commercial aircraft de-

signed for their use, better provision is made for the stowage and rapid removal (for servicing) of the radio equipment they are going to need.

And they may reasonably enquire, also, how long it will be before the historic windmill (which is so rapidly disappearing from the countryside) gives place in turn to the more generally useful engine-driven generator.

RODERICK DENMAN, M.A., A.M.I.E.E., A.F.R.Ae.S.  
Heston.

### THE FRENCH AGREEMENT

[2987] Imperial Airways have just completed arrangements with France whereby our machines will be able to fly over that country on the way to South Africa and Australia.

I hold no brief for Airways themselves, but might I suggest that by the very conclusion of this arrangement a specific argument has been set up against the extension of Government subsidies so far as overseas routes are concerned to any organisation but Imperial Airways, Ltd.?

There is no institution equipped with the same bargaining power, which is so essential in the planning of international air routes. To encourage other organisations to tackle this highly delicate and diplomatic problem would merely be to invite failure.

M. MCKINLEY.

London, N.W.2.

[The agreement applies at present only to aircraft in transit, but negotiations continue.—Ed.]



# MOMENTOUS EMPIRE MAIL PLANS

*Sir Philip Sassoon's Announcement in the House : All First-class Mail by Air :  
More Frequent and Much Faster Services : A 1½d. per Half-ounce Rate*

**I**N the House of Commons last Thursday the Rt. Hon. Sir Philip Sassoon, M.P., Under-Secretary of State for Air, made a most important announcement on the subject of the immediate future of Empire air mail services.

Sir Philip Sassoon said he would, with the permission of the House, make as full a statement concerning the development of Empire Air Communications as was possible at that stage, on behalf of the Secretary of State for Air and also of the Postmaster-General, without whose active support the scheme could not have been evolved.

The proposals were of a far-reaching character and represented the results of many months' work by the Air Ministry and the Post Office, in consultation with Imperial Airways. They were approved by His Majesty's Government in the United Kingdom in the late summer, and full details were subsequently communicated to the other Empire Governments concerned. It would be appreciated that, until the views of all the Governments concerned had been received, the scheme must be regarded as a basis for discussion only, since their agreement and co-operation were essential. He would repeat, this scheme depended for its realisation upon the willing co-operation and support of all the Governments concerned, so that the whole matter rested at present on a purely provisional basis, and his statement that afternoon must not be taken as prejudging the issue.

The scheme contained three main features. In the first place there was to be a very material improvement on present-time schedules between the several parts of the Empire concerned; secondly, there was to be a substantial increase in the frequency of services; and thirdly, all first-class mail to the Empire countries covered by the projected services was in future to be carried by air.

As regards schedules, the scheme as suggested to the other Governments concerned envisaged a schedule of just over two days to India, two-and-a-half days to East Africa, four days to the Cape, four days to Singapore, and seven days to Australia. As regards frequencies, provision

was made for four, or possibly five, services a week to India, three services a week to Singapore and to East Africa, and two to South Africa and Australia respectively.

With regard to the letter rate proposed, he could as yet say nothing definite, but they hoped that in so far as letters posted in the United Kingdom for Empire destinations were concerned, and subject to the successful outcome of negotiations with the Empire Governments, it might be in the region of the present Empire rate of 1½d., but this would apply per half-ounce instead of to the first ounce as at present. Correspondence covering at least eight sides of special light paper could be sent within the half-ounce limit. It would, of course, be for the other participating Governments to fix their own postal charges.

Sir Philip went on to say that an integral feature of the scheme was a comprehensive programme for the development of the ground organisation of Empire air routes on a basis which would enable the services—which would cater for passenger as well as mail traffic—to operate by night as freely as by day.

Finally, he would add that it would not be practicable to give further details as regards finance, types of aircraft, etc., until the negotiations with the other Governments concerned were completed; and, in particular, he could as yet give no date for the inauguration of the scheme. The provision of the necessary fleet, ground organisation, etc., would require a period of something like two years before a project of this magnitude, constituting as it did the largest step forward which had yet been taken in the development of Empire air communications, could be brought into full operation.

Sir Philip concluded by saying that, on the postal side, the Postmaster-General had asked him to make it clear that there was little possibility of introducing the 1½d. postal rate for Imperial first-class correspondence carried by air before 1937.

[A leading article on this subject appears on pages 1371 and 1372.]

## Important Irish Development

**T**HE Irish Free State Government is about to set up a committee to investigate the claims of civil aviation for a subsidy from the public funds. This body, which will hold its meetings in private, will be principally composed of business men who have had some experience of aviation. Members and former members of the Irish Aero Club's Council are also expected to be invited to serve on the committee which will hear evidence from experts.

The decision of the Minister for Industry and Commerce to institute an inquiry follows the proposals recently submitted by a new organisation, Aerlingus Eireann Teoranta (Air Fleets

of Ireland, Ltd.), for the operation of a State-aided air service between Dublin and London.

Our Dublin correspondent recalls the fact that, during the Administration of the late Government, a similar committee was set up and reported that it considered Government financial assistance essential for the operation of a service between the Free State and Great Britain—at least during its "teething" years. As there was very little money available at the time the scheme was not carried out. It is understood that the service to London may be put into operation in the Spring of 1935. British machines will probably be used.

## Diary of Forthcoming Events

Club Secretaries and others are invited to send particulars of important fixtures for inclusion in this list.

Dec. 29. Association Football, R.A.F. v. Oxford University, at Ilford.  
1935  
Jan. 7. "Imperial Air Routes." R.Ae.S. Lecture by Mr. F. Snowden Gamble.  
Jan. 29. Newcastle-on-Tyne Aero Club Annual Dinner and Dance, Barras Bridge Assembly Rooms, Newcastle-on-Tyne.  
Feb. 8. "Ice Formation in Carburettors." R.Ae.S. Lecture by Mr. L. P. Coombes.  
Mar. 1. "Fuels for Aircraft Engines." R.Ae.S. Lecture by Mr. E. L. Bass.

Mar. 5. "Problems of Cold Presswork." Joint R.Ae.S. and Inst. A.E. Lecture by Dr. H. Gough and Dr. Desch.  
Mar. 15. "New Developments of the Autogiro." R.Ae.S. Lecture by Senor Juan de la Cierva.  
Mar. 29. "Piloting Commercial Aircraft." R.Ae.S. Lecture by Sqd. Ldr. H. G. Brackley.  
Apr. 12. "Commercial Aircraft." R.Ae.S. Lecture by Capt. G. de Havilland.  
May. Wilbur Wright Lecture, R.Ae.S., by Mr. W. D. Douglas.

# PRIVATE FLYING

A SECTION FOR OWNER-PILOTS  
AND CLUB MEMBERS

**M**Y stay at Baghdad was rather more prolonged than I had intended, but interesting, nevertheless. I find all along the route that one's progress is apt to be retarded by the hospitality of the people one meets, and at times it is only with considerable diplomacy, or at the risk of appearing ungracious, that the journey is continued without undue delay.

At Baghdad I met a relative, Air Vice-Marshal Burnett, R.A.F., who is A.O.C. the British Forces in Iraq, and received a pressing invitation to stay. I should like to pay tribute to the efficiency of this fine Force, which is upholding British prestige so well in the Middle East.

The real reason, however, for the fact that I found it necessary to stay here two days may be mentioned as a warning to others contemplating a flight over the same route. Before starting, I had, of course, arranged—through the A.A.—for the required permit to fly through Persia. Owing to the delay at the commencement of the flight, my schedule was considerably set back, and it was seen that by the time I arrived at the Persian frontier my permit would, due to a recent enactment, have expired. As soon as this fact was discovered, a fresh application was put in from London, and arrangements made for the permit to be sent direct to the authorities at Baghdad. Official wheels, however, move slowly, and on applying at the British Embassy I found that the permit had not arrived. Mr. Ogilvie-Forbes, the Acting Charge d'Affaires, an Aberdonian clansman, was very helpful in my predicament, and I am also greatly indebted to His Excellency the Persian Minister, who spared no trouble to expedite the required permission. He was most courteous and wired at once to Teheran, with the result that on the second day a telegram was received from the capital to say that I might enter the country and land at Bushire.

## Helpful Officials

**I**N view of the difficulties some have met on the Persian section, I must record with appreciation the fact that I received every assistance from the officials *en route*. To avoid delays of this kind, however, it is desirable to arrange one's journey as closely as possible to the proposed schedule and to make application for permits in good time.

I cannot pass on without recording my general impression of the airport at Baghdad. This is amazingly well equipped, with an hotel, fine station buildings and hangarage. There are good wireless facilities, and the layout and general equipment could hardly be better. It is quite surprising, after visiting other countries with a much longer experience of aviation, to find such a well-organised aerodrome. Imperial Airways are doing great work, and I have every reason to be grateful to their officials for the ready assistance received all along my route.

My permit having arrived, some dates, grapes and pomegranate juice and a supply of water having been taken on board, I set off at 6 a.m. with the object of making

Jask by nightfall. The 500 miles between Baghdad and Bushire took me 5½ hours, and I landed there to refuel. After a stay of an hour, I continued my journey to Jask—a further 500 miles—along the Persian Gulf, and arrived after dusk. In flying east, one has to bear in mind the fact that one loses roughly an hour in every thousand miles, and, of course, the twilight is shorter in the tropics. I found, therefore, that a night landing was involved on several sections between Cairo and Calcutta.

For night flying in such regions one really needs a searchlight with a generator, and I have several times wished for a supply of parachute flares. It is to be hoped that a satisfactory flare of this type, similar to that in common use in America, which can be discharged electrically from a bracket installed in the side or bottom of the fuselage or by hand through the medium of a special pistol, will soon be approved for use in British machines and produced in this country. I had some difficulty in finding the aerodrome at Jask, although there is a small lighthouse there which is kept up by the British as the Persians have not yet seen the

necessity for supplying such equipment for the benefit of those making use of the aerodrome.

## A Night Landing

**T**HE ground staff, however, had put out some lanterns arranged somewhat on the lines of the system I previously described in these columns as being quite effective in such circumstances. With the help of these I made a good landing, and was told that I was only the second pilot to have landed at Jask in the dark. There I stayed at the K.L.M. rest house, dining with the Dutch caretaker and his wife, a Persian cat and two nice Aberdeen terriers. Had there been a moon I had intended to fly the next stage through the night, but as there is no lighthouse between Jask and Karachi, I gave up the idea.

I continued on the following day on the next hop of 600 miles to Karachi, where I duly arrived without incident. I occupy my time on the long day flights by writing these notes and by trying to catch up with correspondence. For this purpose I find a pad with a large spring clip, which fits on the leg above the knee, of great assistance. Just before leaving England I was presented with a bottle of fountain-pen ink which dries instantaneously, and this proved very useful indeed when writing in the air.

Weather conditions along the route through Persia to Karachi were good. The dreaded sand storms or, more correctly, dust storms, are more prevalent in the spring and summer. The last stage to Karachi took me over the sea for a hundred miles or so, where I had to give up writing and attend to navigation. The presence of various kinds of fish swimming on the surface of the water was very noticeable at this point. I could make out large turtles, some of which must have weighed over one hundred pounds, and also what appeared to be dogfish and crabfish. I reached Karachi after seven hours' flying, gladly enough, as my petrol was getting low.

## NOTES

by

LORD SEMPILL

A.F.C., F.R.Ae.S.



# FROM THE CLUBS

## *Events and Activity at the Clubs and Schools*

### LANCASHIRE

In addition to the Christmas holiday, the Lancashire Aero Club will be closed on Monday and Tuesday, December 31 and January 1.

November's flying total was almost double that for the corresponding month last year. First Autogyroptic solos were made by Messrs. Goodfellow, Wilson and Gatenby.

### NORTHAMPTONSHIRE

Bad weather during the week ended December 16 did not handicap the flying at Sywell, and a considerable increase in flying hours was shown, a number of these being put in by blind-flying pupils, one of whom, Mr. F. R. Wilson, has completed his course. New members include Messrs. R. T. Benson and Mr. Eric De Ville, and Mrs. Crossley is taking a course in advanced aerobatics.

### HANWORTH

Flying hours for the week ended December 15 reached 21 hr. 40 min.—a very good figure, taking into consideration the very heavy rain and so on. Two "A" licences were obtained by D. Wilkie and C. Mills, both of the Insurance Flying Club. Cross-countries were made by members to Paris, Stoke-on-Trent, Shoreham and Bournemouth.

The reception after the marriage of Mr. A. L. T. Naish (a director of the Aircraft Exchange and Mart, Ltd.) and Miss Hetty Wincott on December 14 was held in the Hanworth Country Club. A formation of Blackburn B.2 machines from Hanworth, and a formation of "Moths" from Brooklands, flew over the church at Thames Ditton.

### HERTS AND ESSEX

Nearly 300 people attended the fourth annual dinner of the Herts and Essex Aeroplane Club on December 18. Mr. and Mrs. Mollison, as joint Presidents, read a gracious reply from H.M. the King to a telegram which had been sent to him expressing the loyal sentiments of the members.

Mr. Mollison proposed the health of the visitors, and in doing so drew attention to the fact that the Club now numbered 200 "A" licensed pilots amongst their members. Mr. Cathcart Jones, in reply, said that the trials of the England-Australia race, despite the widespread organisation, had only served to emphasise the magnificent performance put up by their President when, as Amy Johnson, she flew to Australia *without* such organisation.

Lt.-Col. Shelmerdine, Director of Civil Aviation, presented the following Challenge Cups: The Wrighton Cup to Mr. K. J. Lindy; the Mollison Cup to Mr. V. A. Ercolani; the Shelmerdine Cup to Mr. P. T. Buckingham; the Margaret Blackshaw Cup to Mr. D. C. Mason; and the Janet Lady Brickwood Cup to Mr. L. F. P. Walters. After presenting the Cups, Lt.-Col. Shelmerdine drew attention to the progress the Club had made and to the fact that during the past year they had risen from seventh place in the list of Clubs, according to the number of hours flown, to fourth place. He also jocularly hoped that

the Club members would not habitually make forced landings in the River Thames.

Capt. F. A. Mason, His Majesty's Postmaster, proposed the health of the Club, using impressive statistics of its progress. Up to November this year the 395 members of the Club had flown 2,564 hours and had gained 34 "A" licences; in the three years of their existence they had gained 122 "A" licences and flown 6,780 hours.

Mr. S. A. Perrin replied to the toast and praised the keen way in which the members worked together to make a success of everything they undertook. Parmentier and Moll, surprisingly enough, looked in during the proceedings and received a vociferous welcome.

### YORK COUNTY

The annual Christmas party was held at the club on December 15. Some 150 members and friends took part in the dancing and games, and the prizes were distributed by Capt. Norman Blackburn.

### LONDON GLIDING

The most interesting news of the month is the official announcement concerning the National Altitude Record established on September 4 by Mr. G. M. Buxton. At that time it was believed that an altitude of 7,970ft. had been attained, and the sealed barograph and other data were despatched to the Royal Aero Club for official confirmation. After investigation, however, it has now been officially homologated at a higher figure, namely, 8,323ft. (2,537 metres). The true merit of Mr. Buxton's flight becomes more apparent when it is realised that it is within the small margin of 52 metres of the World's Record. The machine used by Mr. Buxton was an all-British Scud II Sailplane, and the club is naturally proud that both the designer and the pilot are club members.

The advent of winter has had little noticeable effect upon club activities, although the lack of thermal lift has naturally placed considerable restriction upon cross-country and high altitude flying. Many hours of hill soaring have, however, been recorded, the Falcon, Scud and Westpreussen sailplanes being particularly active, the last-named having made a number of flights for the purpose of testing a new type of low reading (10-80 m.p.h.) air speed indicator, which has proved highly satisfactory, and is manufactured by Smiths Instruments, Ltd. Membership continues to grow at a satisfactory rate, twenty-eight new members having joined since October. A new primary training machine has been added to the club fleet, which now totals ten. Yet another sailplane is on order.

Members continue to show increasing interest in glider construction, and the committee is at present carrying on negotiations which will enable them to provide facilities for glider construction, under expert supervision, in London. The club year ends on January 31, but intending members should note that by joining now they obtain full membership privileges for thirteen months upon payment of one year's subscription.

## College of Aeronautical Engineering : Year's Work Reviewed

SOME five hundred people attended the annual dinner and dance of the Automobile Engineering Training College and the College of Aeronautical Engineering, held in London recently.

The Principal, Mr. C. H. Roberts, in proposing the toast to the automobile and aeronautical industries, gave a brief account of the progress of the colleges during the past twelve months. This year, he said, had seen the termination of the training of the first aeronautical engineering students, all of whom had acquired suitable positions in the industry. In this connection, also, Mr. A. H. Martin had been awarded the Mollison Trophy as the best aeronautical student of the year; this student had been appointed a technical assistant at the Royal Aircraft Establishment, a post which he obtained in competition with 400 others.

Mr. Roberts spoke of the great help which the England-Australia Race had been to the industry, and expressed his gratification that they had with them Mr. Cathcart Jones. He also referred to the satisfaction they felt in the fact that a number of the College students had been asked to assist at Mildenhall prior to the take-off of that great race—assistance which had been appreciated by the authorities.

Sir Malcolm Campbell replied for the automobile industry and Mr. H. R. Gillman for the aeronautical industry. The latter deplored the continued imposition of petrol tax on the users of aeroplanes, especially as the tax largely goes to swell the road fund. He thought [with justification—Ed.] that the College students were very well trained indeed, and that there was always room in the industry for well-trained men. Thereafter he opened a slashing attack upon the Air Ministry and its regulations, while upholding the tenets of the Gorell Committee as being a panacea for the ills of the industry.

## Good Work at Belfast

In the first three months' operation at the Airwork School of Flying at The Ards Airport, Belfast, 194 hr. 25 min. have been flown. Most of this was done on the school's first Avro "Cadet," but during November another "Cadet" was put into service.

As most of the pupils have been trained "ab initio," very little solo flying was done in the first two months, though November returns show approximately 16 hours' solo to the credit of newly graduated pupils.

## SCOTT AND BLACK HONoured

*A "Welcome Home" Banquet for the Australia Race Winners : Parmentier and Moll Present, together with Many Notable Figures in the Aviation World*

**N**EARLY nine hundred people attended a dinner at Grosvenor House, London, on December 19 in honour of Messrs. C. W. A. Scott and T. Campbell Black. The occasion was in the nature of an official welcome to the winners of the England-Australia Air Race, and was given jointly by the Royal Aero Club, the Royal Aeronautical Society, the Air League of the British Empire, and the Society of British Aircraft Constructors.

Lord Gorell occupied the chair in the regrettable absence, through illness, of the Duke of Atholl, President of the Royal Aero Club. Lord Gorell, who is chairman of the Royal Aero Club, read this telegram from the Prince of Wales:—

"I am glad to hear that the Royal Aero Club are entertaining Scott and Campbell Black on Wednesday night, when I know they will be assured of a great welcome. Please give them my best wishes on their return home."

Capt. Geoffrey De Havilland, who is taking a well-earned rest after a strenuous year's work, wired as follows:—

"Very sorry to be away to-night, all who helped build the "Comet" have unbounded admiration for the splendid achievement of Scott and Campbell Black, and sincerely congratulate them on their victory."

Lord Londonderry, Secretary of State for Air, in proposing the health of the two guests of the evening, remarked that after the long preparations they all remembered at Mildenhall, only the short space of time of seventy hours had elapsed before the race was over. They admired the resource and courage of the pilots and particularly the sense of humour they had displayed, a spirit which got them through in the face of great difficulty. The race marked an introductory chapter in the progress of civil aviation. They were delighted that a British firm had been able to assimilate what American experience had taught, and in five months had turned out three machines which had acquitted themselves so successfully.

### Beneficial Technical Developments

Lord Londonderry recalled previous flights between England and Australia, and he felt that progress had been made, as the ground organisation was now much better. He also thought that retractable undercarriages, flaps and variable-pitch airscrews had proved themselves responsible to a large extent for reducing the time taken between the two countries. Mr. Scott, he said, had broken the record every time he had flown between England and Australia.

Mr. Scott replied with a humorous and fluent speech, emphasising that it was team work which won the race. He also drew attention to their dependency on the organisation of the Royal Aero Club, the constructors of the aeroplane, and the ground services along the route. He remarked that one of the greatest factors in helping them to win was the magnificent refuelling organisation which attended to their wants at every aerodrome with such speed.

As an example of what he meant by team work, he mentioned that when crossing the Timor sea and some 250 miles out from Darwin, they saw bad weather ahead, and came down from 11,000 ft. to 1,000 ft. so that they were just under the cloud bank. It was then that one engine wavered, and they had to fly with that engine throttled right back. With-

out a word Black took over the control column and concentrated on gaining every foot of height, while Scott himself took over the rudder bar and gave all his thought to keeping the machine on its correct course.

Mr. Scott also gracefully expressed their sincere regrets and sympathy with the unsuccessful competitors, and in conclusion he mentioned the appreciation they all felt for Mr. A. O. Edwards, whose machine it was they flew, and through whose agency they had been able to win the race.

Mr. Campbell Black deprecated the fact that the team work between Scott and himself was so good that Scott thought the same as he did, and had, therefore, robbed him of all his points for his speech! He thought that the event had demonstrated to the full the extent of the friendly international feeling between pilots. Parmentier and Moll had, he said, actually arranged for laurels to be waiting for them (Scott and Black) on their arrival in Melbourne. He hoped that everyone would benefit from the marvellous example set by the losers.

Lord Gorell proposed the health of the competitors, and pointed out that his toast and the previous one overlapped, as their guests were also competitors. He referred with admiration to the feats of some of the other competitors, such as the records set up by the Mollisons between England and Baghdad, and England and Karachi.

Mr. A. Plesman, Chevalier K. D. Parmentier and Mr. O. Cathcart Jones replied for the guests. Mr. Plesman thought that the race would benefit the public, as from the lessons learned they would get better aviation. Mr. Parmentier thanked Commr. Perrin and the Royal Aero Club for the helpfulness of the whole organisation, and he thought that the race had shown that a service, carrying passengers in comfort, could be operated in seven days to Australia. He expressed great admiration for Scott and Black, who had had to fly throughout the race without the help of wireless. Mr. Cathcart Jones said that the race was won on the ground as much as in the air, and he thought that great credit was due to the Committee of the Royal Aero Club for the way they had interpreted the rules to the pilots of several Nationalities.

The toast of "The Chairman" was proposed by Lt.-Col. J. T. C. Moore-Brabazon, President of the Royal Aeronautical Society. Lord Gorell, in a short reply, expressed the grateful feeling of everyone to Sir Macpherson Robertson.

On Friday, January 4, Messrs. Scott and Black are to be entertained by the City Livery Club at a luncheon at Grocers' Hall. The Lord Mayor of London, the Lady Mayoress, the Sheriffs and their ladies will be present.

### Director General of Civil Aviation: An Important Announcement

The Air Ministry announces that the Director of Civil Aviation will in future be designated the Director General of Civil Aviation. The present Director, Lt.-Col. F. C. Sheldermine, C.I.E., O.B.E., will be the first Director General.

A leading article on this subject appears on page 1372.



**BUILT TO AN IDEAL:** The Cambridge Aero Research "Snark," described on p. 1378.



# The AIRCRAFT ENGINEER

## "FLIGHT" ENGINEERING SECTION

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## WING FLAPS

By R. P. ALSTON

*Below are given the more technical aspects of the paper on "Wing Flaps and Other Devices as Aids to Landing" read by Mr. Alston before the R.Ae.S. on December 6*

### Wind Tunnel Tests

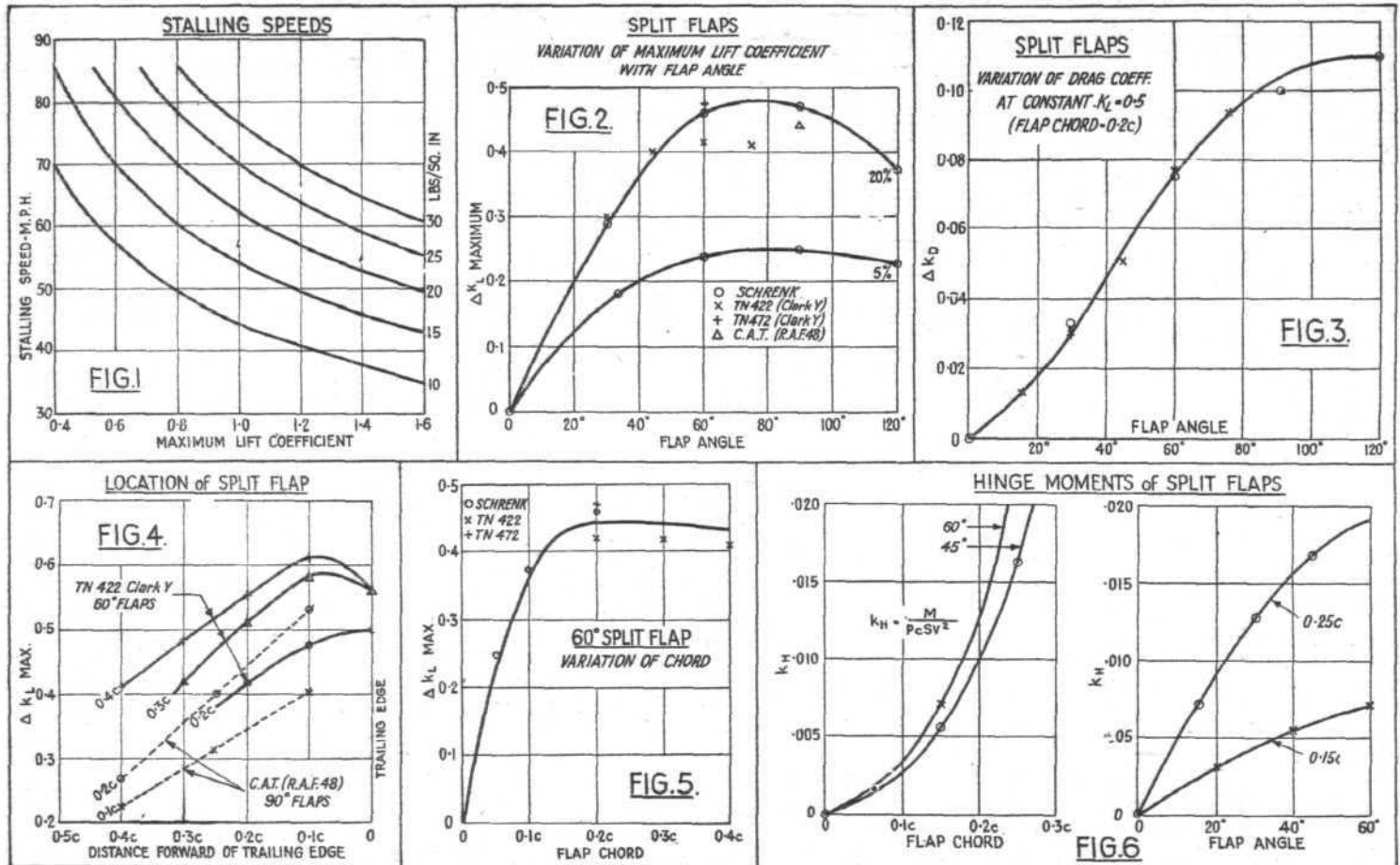
THE validity of wind tunnel tests at low Reynolds numbers has always been open to doubt in the matter of maximum lift coefficients, and even compressed air tunnels are not entirely above suspicion on account of turbulence. There is, however a saving grace where split flaps are concerned, which is that various different tunnels agree in giving unaltered stalling incidence when the flap is in operation. The change in  $k_L$  max. due to the flap is therefore probably not much in error. Fig. 2 shows the effect of flap angle on the change in maximum lift coefficient for a split trailing edge flap running across the whole span. The curves are taken from Gruschwitz and Schrenk's experiments for a 20 and 5 per cent. chord flap; the other points are from American experiments on a 20 per cent. flap; the increase in drag coefficient at  $k_L = 0.5$  is plotted in Fig. 3. It will be noticed that no advantage in lift is gained by having a larger flap angle than 60 deg., though the drag increase continues to rise with flap angle. The effective drag increase obtainable with a flap is, of course, more than that shown in Fig. 3 since there will be extra induced drag due to operating at a higher  $k_L$ .

The effect of flap location is shown in Fig. 4, whence it appears that the further back the flap is, the greater the maximum lift coefficient. The effect on drag is negligible. Unless some mechanism such as the Zap is utilised to slide back the leading edge of the flap, the furthest aft location is limited by the flap chord in the closed position. The effect of varying chord for total span split flaps deflected 60 deg. is shown in Fig. 5, where the loss of lift due to forward location is seen to exceed the gain due to size when the flap chord exceeds about 30 per cent. of the wing chord. Drag continues to rise, however, as would be expected.

The effect of variation of the flap span has been investigated in detail for a 20 per cent. chord flap at 60 deg.

deflection, cut away at the tips and centre in turn. The results are as one might expect; removal of the flap from the centre causes a rapid drop in lift and so disturbs the span distribution that the induced drag is increased; removal of flap from the tips does not decrease the maximum lift seriously. It is a pity that these experiments were not associated with any measurements of tail flow since there is a certain amount of full-scale evidence that in order to maintain sufficient downwash at the tail on low-wing monoplanes it is essential to run the flap right across the centre of the wing span. Comparison of the lift curves at equal values of maximum lift shows a less sudden drop at the stall when the centre is cut away than when the tips are cut away. One of the first machines to be fitted with a split flap was the Northrop "Sky Chief," on which the flaps ran from the end of the wing-body fillet to the wing tip. "Park bench" ailerons (which will be discussed later) were fitted. It was stated by Mr. Northrop that the stall on this aeroplane was not violent, a fact which may be attributable to the non-flapped centre portion of the wing.

Before going on to discuss the various forms of special ailerons that are required if flaps are run right out to the tips it may be as well to determine what can be done with partial span flaps. It has already been shown that a flap chord of 20 per cent. and a deflection of 60 deg. need not be exceeded from a lift point of view. On a typical tapered wing monoplane, the ailerons need not exceed 40 per cent. of the span so that the central 60 per cent. is available for a flap which, on a rectangular wing, would give an increase of 0.325 in  $k_L$  max. Owing to the concentration of load at the centre of a tapered wing this figure may be increased to 0.35. For a wing loading of 16 lb. per square foot and a  $k_L$  max. of 0.7 (no flap) the stalling speed is 67 m.p.h., which would be reduced to 54.5 m.p.h. by the flap. The increase in gliding angle at 20 per cent. above stalling speed would be 6 deg., which would be adequate to bring even a very clean aeroplane above the war-time standard of



19 deg. Estimates of the effect of the flap on the Douglas D.C.2 suggest a reduction of stalling speed from 68 to 59 m.p.h. and increase in gliding angle of 3 deg. The minimum distance to come to rest after clearing a rooftop obstacle is calculated to be reduced from 2,000 to 1,350 ft. This calculation is based on the assumption that the approach is made at the minimum speed from which complete flattening out is possible in each case and that the coefficient of friction on the ground is 0.3 with brakes. It should be noticed that any excess of speed on the approach will result in a greater increase of run for the unflapped aeroplane. It appears, therefore, that in order to make a clean, heavily loaded aeroplane reasonably easy to land it should not be necessary to have full-span flaps. This conclusion would appear to have been justified in practice since no full-span flap is believed to be in use commercially now except on the Pander Postjager.

### Special Ailerons for Use With Full-span Flaps

If a split trailing edge flap is run right out to the wing tip some unconventional form of aileron must be employed. One method is to use ailerons in the normal position but so arranged that they move upwards only, through a large angle. American model tests show that the angle has to be about 70 deg. to give rolling moments comparable with those of conventional ailerons. Ailerons of this pattern have been tried in flight on the Fairchild F.22 monoplane with a full-span split flap and are believed to have been abandoned on account of excessive hinge moments. An alternative developed by the N.A.C.A. is a retractable curved plate aileron which need involve no aerodynamic hinge moment; these ailerons have been used successfully on the F.22, but they must involve considerable extra weight.

Leading edge spoilers or interceptors appear very promising from model tests, but when tested in flight by the N.A.C.A. they gave an initial reversed control equivalent to a half second lag.

The only remaining solution is an auxiliary aileron mounted above the trailing edge of the wing, a type

christened "Park bench" in the U.S.A. According to the Zap Corporation, who use this type in conjunction with a full-span Zap flap, the exact location of the aileron and its zero setting is very critical. A feature of this type of aileron is that its rolling moment coefficient is increased when the lift flap is down so that adequate control should be preserved at low speeds. Possible objections to this type are its extra weight, drag at high speeds, and likelihood of causing torsional distortion of the wing owing to its far back location, but full-scale tests in this country will shortly settle these points.

### Pitching Moments Due to Split Flaps

The effect on longitudinal trim when a flap is pulled down is rather complex since it involves three factors, the backward shift of the wing centre of pressure, the lateral shift of the  $k_L \sim \alpha$  curve, and a change in downwash over the tail. There is also the possibility of the turbulent wake causing a drop in tail efficiency. The simplest condition to consider is that of unaltered speed when the flap is down, i.e.,  $k_L$  is kept constant, which means that the incidence is reduced. Consequently there is a nose up pitching moment produced by the reduced incidence of the tail. At constant  $k_L$  the downwash at the tail should be practically unaltered for a full-span flap. From model tests on split flaps of chord varying from 15 to 30 per cent.,



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the wing pitching moment has been plotted against incidence for various flap settings at constant  $k_L$  (0.5).  $dk_m/da$  from these points has a value of 0.009 per degree. An average tail plane designed to give adequate longitudinal stability may have a value of 0.007 for  $dk_m/da$ , so that there is a net nose down pitching moment of 0.002 per degree change of incidence at constant  $k_L$ . For full flap angles the change in incidence is about 12 deg., giving a net pitching moment coefficient of -0.024 only. Some tests made by the Zap Corporation on models of the XOJ-1 biplane and Parnall Parasol monoplane even show resulting nose up moments at a given  $k_L$  and practically no change in moment at maximum lift. In these tests it is hard to see where the additional nose up moment comes from.

Failure to carry the lift right across the centre of the wing, either due to interruption of the flap or to bad body-wing interference will reduce the down-wash at the tail for a given lift coefficient and almost certainly make it impossible to attain stalling incidence if that incidence is only just attainable with no flap. In order to ensure that stalling incidence is just attainable with and without flap it may be necessary to gear together the flap and tail plane adjustment or alternatively to arrange that the gearing between elevator and stick is increased as the flap is pulled down. The former system was adopted in the Fieseler 97 in the Rundflug competition. This machine has a Fowler flap involving a very big C.P. movement and its tail plane is set down 16 deg. by full flap movement. In spite of this its minimum speed figure (engine on) only gives a  $k_L$  of 1.57, so it is quite likely that there was insufficient longitudinal control to trim the aeroplane to the incidence for maximum lift, though engine power and lateral control may also have been inadequate.

The sharp drop in lift at the stall that has been noticed in model and full-scale wind tunnel tests of split flaps has given rise to some anxiety on the score of a possible large loss of height in recovery from a stall, combined with acute lateral instability. Mr. Relf has suggested that on this account the longitudinal control should be limited to prevent the attainment of stalling incidence, but full-scale evidence on this point is needed.

### Operating Forces for Split Flaps

Data on the hinge moment and centre of pressure of a split flap are a little scarce. Curves of hinge moment for flaps of varying chord are shown in Fig. 6. For such flaps the hinge moment is very nearly proportional to the angle of deflection. The rapid increase of hinge moment with chord shows that flaps should be kept as long and narrow as possible for a given area, a requirement in conflict with the avoidance of aileron troubles. A calculation based on these hinge moment figures shows that the moment required to hold down the flaps of a machine like the Douglas D.C.2 is about 700 lb. ft. at 75 m.p.h. This demands the use of auxiliary operating gear which may be electric or hydraulic but is bound to be fairly slow acting. A criticism of the flap installation on the Northrop "Sky Chief" was that 45 turns of a crank handle were required to get the flaps down; this manual system has been replaced on later Northrop machines (with smaller flaps) by a hydraulic gear, and it appears that manual operation of a plain split flap of useful size is impracticable on any but light aeroplanes.

It is in connection with operating force that the Zap arrangement is of principal interest; by hinging the flap to a link about one-third of its chord back and allowing the nose of the flap to slide back, the flap may be nearly in balance at high angles. The position of the flap C.P. is open to some doubt; N.A.C.A. tests on plain split flaps show that, at the operating incidences, the C.P. moves back from 30 per cent. of the flap chord at 15 deg. deflection to about 40 per cent. at full deflection, whereas some tests by the Zap Corporation show the C.P. to move forward from 0.5 to 0.3 of the flap chord as the angle increases from 20 deg. to 40 deg. On the latter basis the flap is self-

opening at high angles. For a simple hinged trailing edge flap there is a theoretical relation between hinge moment, flap angle and lift coefficient due to H. Glauert; this relation has been checked very closely by pressure plotting on a R.A.F. 30 flapped wing and by direct measurement on a R.A.F. 31 model. The results show a straight line law for  $k_H$  against flap angle at a given  $k_L$  and the value of  $k_H$  at 45 deg. flap angle is identical with that for the split flap given in Fig. 6.

### The Slotted Flap

The principle of operation of this flap has already been referred to, and it would be expected that the drag would be comparatively low. Wind tunnel tests on a Handley Page slotted flap of 20 per cent. chord ratio show an increase in  $k_L$  max. of 0.445 at 40 deg. deflection and an increase of only 0.018 in  $k_D$  at  $k_L = 0.5$ . With the slot blocked up  $\Delta k_L$  max. = 0.32,  $\Delta k_D = 0.017$  at  $k_L = 0.5$ . Some other tests on slotted flaps show them to be the type having the least increase in drag for a given increase in maximum lift coefficient.

With regard to hinge moments, no figures are available, but it appears possible to locate the hinge in such a position that the flap is well balanced and has a suitable slot opening. There is no advantage in having the flap angle greater than 40 deg., so that the range of movement is less than that required from a split flap to give the same increase in maximum lift coefficient.

### Air Brakes

All the devices discussed above have been regarded principally from their effect on maximum lift, and the drag has been left to look after itself. If  $K_L$  max. is assumed to be increased by a flap from 0.6 to 1.0 then  $K_L$  on the glide will be increased from 0.45 (at 15 per cent. above the old stalling speed) to 0.7 (at 20 per cent. above the new stalling speed). For an effective aspect ratio of 6 this means that the induced drag coefficient is increased from 0.021 to 0.051. The parasitic drag may be increased any amount from 0.016 for a slotted flap to 0.089 for a 90 deg. split flap, so that the total increase in gliding angle, given by  $\tan^{-1} \Delta k_D/K_L$  ranges from 2.8 deg. to 11.5 deg. This can be said to cover any normal requirement, ranging from the case of low drag increase where improvement in take-off is required to quite a high drag increase where short landings are required.

There are other means of increasing drag alone without altering the wing lift characteristics, but they are not very effective. A retractable undercarriage which is badly faired when down, rotatable strut fairings, flaps projecting from the fuselage, and such devices are only capable of producing quite small drag increases. A variable pitch airscrew windmilling at very low pitch has been calculated to give quite a good braking effect, but the tail controls might be impaired by a "negative" slipstream. A device which acts as a pure air brake and has been tried successfully in flight is the D.V.L. gliding angle control. This consists, essentially, of two small surfaces, one on the upper surface of each wing, which are parallel to the plane of symmetry when out of action and can be rotated about a vertical axis. When turned normal to the direction of flight they break up the span distribution of loading and so increase the induced drag of the wing appreciably though their own parasitic drag is small. Flight tests on a German low-wing monoplane showed an increase of 5 deg. in minimum gliding angle with this device without appreciable increase in stalling speed.

### Weight of Flap Installation

There is very little evidence in this respect. Experimental flap installations on the Parnall Parasol monoplane give figures of 250 lb. for the complete outfit, including controls, of a 28 per cent. chord Zap flap of full span, except for a small centre section cut away, and 65 lb. (estimated) for a 10 per cent. chord full span curved

retractable flap and associated controls. The former has already been fitted to a R.A.F. 28 section wing and involves "Park bench" ailerons, the latter is shortly to be fitted to a R.A.F. 48 section wing; both wing areas are 294 sq. ft. The Zap installation weighs 8 per cent. of the all-up weight of the aeroplane and, from Fig. 4, should give a 75 per cent. increase in  $K_L$  max. The retractable flap installation weighs 2 per cent. of the all-up weight and, from Fig. 4, should give a 40 per cent. increase in  $K_L$  max. The weight figures in both these cases are for experimental installations on existing wings and are probably unduly heavy on that account, but even so a device which itself weighs only a tenth of the increase in lift that it gives may be regarded as good.

Speeds of operation of commercial and military aircraft are steadily rising owing to competition and in the U.S.A.

there is hardly a passenger transport aeroplane not fitted with some form of flap, and some of their military machines are now fitted with slots and flaps.

Where high top speed is essential, landing devices will be used, not to reduce the landing speed, but to keep it the same, increase the wing loading and so obtain a higher top speed. Calculations show that even with a split flap used for landing only (on account of its high drag) the performance of a typical two-seater fighter could be increased by at least 10 m.p.h. on top speed and a variable amount on climb according to how the aspect ratio is changed. A maximum lift coefficient of 1.1 which is really usable at a normal stalling angle now appears to be possible; this permits a wing loading of 20 lb. per sq. ft. for a stalling speed of 60 m.p.h., and 30 lb. per sq. ft. at 74 m.p.h., which is not an impossible speed for a large flying boat.

## SOME NOTES on the PARIS AERO SHOW

By H. J. POLLARD, Wh.Ex., A.F.R.Ae.Soc.

*Mr. Pollard, as many readers will know, is on the Technical Staff of the Bristol Aeroplane Co., Ltd. Below he comments on Metal Construction, Three-ply Construction, and several other Aspects of the Machines exhibited at the Paris Aero Show*

OF the seventy or so aircraft exhibited at the Paris Show, the majority were, of course, monoplanes, of which less than half were "metal covered" in the usually accepted sense of the term; that is, while the main surfaces are metal-clad, the rudder, ailerons, etc., may be fabric covered, a convention which permits the use of the term "all metal," just as a biplane of which the general structure and the internal framework is of metal construction is referred to as "all metal" in spite of complete fabric covering.

A question at once arises that requires an answer. Why were most of the monoplanes shown three-ply covered? The answer most frequently given is that in small-quantity production the use of three-ply has an appreciable influence on cost. If, however, long service in all parts of the world is taken into account, then few will argue in favour of three-ply, particularly where the climate is moist and hot. At the same time large numbers of aircraft will be operating in more temperate and favourable climates; consequently the use of three-ply as a material for "stressed-skin structures" is worthy of further consideration.

The fundamental expression for the critical stress at which plane panels buckle under shear or compressive forces acting in the plane of the panels is

$$p = kE (t/b)^2$$

where  $p$  = Critical stress  
 $E$  = Young's Modulus  
 $t$  = thickness of sheet  
 $b$  = width of sheet  
 $k$  = constant

By working on a weight-for-weight basis, and using appropriate values of Young's Modulus and density, it is easy to show that three-ply in panel form is a more economical proposition than any sheet metal.

Here, then, is one good argument for its use. Against it there is the very important consideration of water soakage. It is well known that the weight of a ply-covered boat hull can be very adversely affected through this cause. The same thing, to a much smaller degree, of course, happens with landplanes made from ply—with ultimate disintegration of the material. In the case of large landplanes

such as cannot readily be moved into hangars, or for the largest aircraft that would have to remain out in any weather, the use of three-ply is unthinkable.

The comparatively large percentage of civil aircraft exhibited in Paris, made from three-ply, forces one to review all the arguments that can be urged in favour of the material. Cost for small production (which is another way of making allowance for factories ill-equipped for metal work) has already been mentioned. The fundamentals in regard to the strength of sheeting under planar forces is a second favourable argument. A third argument often used relates to external appearance, i.e., freedom from buckles. This argument immediately loses its force when really thin ply, say  $\frac{1}{16}$  in. thick, is used. Thick ply, as used on the Heinkel 70 body, has always a good appearance—so long as it is not exposed to moisture for a long time. Judging, however, from the appearance of the three-ply exhibits they were no whit better, on the average, than those made from sheet metal, and the best looking body on show—the Czechoslovakian Avia 534—was made of metal; the third argument, therefore, cannot be admitted.

### Strength and Cost

A fourth and last point put up in favour of three-ply is that it is readily repairable with tools available anywhere in the world. A better way of stating the case appears to be that structures made from ply are less susceptible to damage, since if, for example, a bad landing is made, sufficient to cause damage, then the damage is not likely to be less than a complete "write-off," for if the forces are sufficient to buckle panels beyond repair, then the splintering of the framework used for the attachment of the panels would be a certainty. All the available evidence appears to indicate that ordinary metal *monocoque* constructions are adequately robust.

Summing up on this point, it would appear that the main factors in favour of three-ply are low initial cost and high strength-weight ratios. As to the latter, conclusive data are difficult to obtain. From the material laws it follows that three-ply constructions should be



lighter than similar sheet-metal ones. The question is, are they sufficiently strong after a fairly long period of time? If, on the other hand, they are rendered quite weatherproof, does not the weight necessary for that purpose nullify the advantages?

On the question of cost, it must be remembered that the "shapes" obtainable when three-ply is used are strictly limited: there can be no double curvature. A beautifully shaped body such as the Avia fuselage could only be obtained through the use of large numbers of narrow strips glued and screwed together. Three-ply would be good for slab-sided bodies. Low drag aircraft do not have slab sides and sharp corners. The summing up of the whole matter appears to be that the constructor who pins his faith on three-ply is, in the long run, placing himself at a disadvantage compared with the constructor who has resources sufficient to enable him to weather the expense that the development of the technique for the production of streamlined metal bodies must entail.

One feels that an apology is needed for this extended consideration of an old topic, but the extensive use of three-ply at the Show certainly calls for more than passing comment. It is clear that persisting with, or even reverting to, the material is not progressive. This was one constructional aspect that was disappointing, the more so since certain military aircraft employed this material in structural form.

### Buckles—a Cause of Unsightly Surfaces

Another source of disappointment at the Show was the poor appearance of most of the surfaces in both metal and wood. Paradoxically, this was also a source of gratification, inasmuch as one was concerned in some small measure with the manufacture of one exhibit which was by no means free from buckles. While "good enough" for "first-off," it did not reach one's ideas of Show standard. In actual fact, however, the Bristol main exhibit was, as regards finish of surfaces in metal, second only—and a good second—to the Avia 534. A main reason for disappointment was because Continental exhibits have had "rigid skinned" aircraft on their stands in several previous Shows and one expected them to have reached the acme of perfection by this time; such, however, was far from being the case.

Unquestionably, the surface appearance of aircraft generally will have to be improved. The time is approaching when civil aircraft will be exhibited with price tickets attached, and it will then be a poor look-out for the salesman who has machines to offer in which the surfaces have the appearance of being well trampled on after assembly. The argument that the surfaces buckle anyhow under load a long while before they rupture will not avail against such appearances, and it must be emphasised that the production of aircraft having fair surfaces is not an insuperable difficulty.

### Problems of External Projections

Almost (but not quite) as important as buckles are projections, such, for example, as external corrugations (Junkers), external stiffeners (Bloch), and protruding rivet heads (most exhibitors). Here, certainly, is a problem for early solution. Everyone wanted to know why sheeting was not flush-riveted. The answer is that that could be done, but since very thin sheet metal is used, and since much of the riveting cannot be done by a machine, such, for example, as the De Bergue, riveted smooth-surfaced structures cannot be produced until the correct technique has been determined. This matter is being examined now, but something had to be left until the last, and flush-riveting was regarded as of secondary importance, which, of course, it is, compared with joint strength. Hitherto, smooth-riveted surfaces in very thin metal have been looked on as a refinement, and in this connection it is as well to remember that in the highly successful

Northrop and Douglas D.C.2 aircraft, all external rivets have snap heads.

One hastens to add, however, that flush-riveting has long been practical (our own Schneider Trophy winner, for example), and in the Show the single-spar Dewoitine D.510, together with the Polish P.2.C. aircraft, had flush-riveted surfaces. Hitherto the difficulty has been the time factor, and consequent expense involved, but with the ever-insistent demand for lower drag and higher speeds flush-riveting becomes an essential, apart from the question of appearance; for lower drag alone flat riveting is necessary over the leading portion only of wings, but once a speedy technique is developed the use of these rivets will be extended to all parts of every surface. *A propos* of the question of flush-riveting, it was curious that on the Bloch 211 the wings up to the front spar had ordinary snap heads, while aft of the spar all rivets, on the wing underside at any rate, were countersunk or the sheets deformed with the rivet to give a countersunk effect. Clearly, these latter had been formed on a machine as a separate bench job. The beneficial effect (if any) on this part of the wing of these buried heads was, however, nullified through the use of outstanding angle flanges provided at the transverse edge of each sheet. By riveting these angles together in pairs the assembly of the wing covering is greatly facilitated, but a much cleaner job would be obtained if the separate reinforced sheets were screwed to the internal structure of the wing without resort to the external downwardly projecting flanges on the upper surface. This matter of screwing on under surfaces is likely to become the vogue from the point of view of ease of assembly and maintenance.

### Resistance-welding and Fatigue Stresses

Most of the troubles relating to local projections from surfaces can be overcome through the adoption of spot-welding; this subject was dealt with by Mr. Langley last month. As, however, there are one or two additional things to say about that process, this is the appropriate place in which to interpolate such observations.

The crux of the whole matter of resistance-welding lies in the fatigue strength of the welds. Let it be borne in mind that the sheets and strips are most carefully rolled and heat-treated to ensure that the proper microstructure is obtained, without which the whole of the specified physical properties of the material would be unobtainable. Sheet or strip of this material is then "boiled-up" and fused together, the microstructure at and near the weld then being vastly different from the carefully prepared state that exists away from the welds. The almost inevitable result is that under vibratory conditions of sufficient intensity fatigue cracks must be generated from the welds. By heat-treatment subsequent to welding the chance of these cracks developing can be largely eliminated, but, even then, not quite wholly. In the case of a *monocoque* body, however, heat treatment after welding is outside the bounds of possibility. Fortunately, in the case of such a body the induced static and superimposed fluctuating stresses are very low, and perhaps no trouble need ever arise, certainly not with certain stainless and Mn-C steels, but with light alloys it is extremely doubtful whether freedom from fatigue cracking could ever be guaranteed. The proof of the pudding is, of course, in the eating, and these machines may do all that is claimed for them, but an extended series of vibration tests is heartily recommended, the basis of comparison being the corresponding riveted joint. In the case of a highly stressed member, such as a wing spar, long and exhaustive tests are an absolute necessity if safety is to be ensured. The manufacturers of the necessary welding apparatus exhibiting in the Show claim great advances of late. The writer has described some experiments on this work (see *Aeronautical Journal* for July, 1934); a repetition of those experiments on samples welded in one of the later type

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machines may—and one hopes that it will—cause modification of views and recasting of ideas on this subject. The reader is warned, however, not to be misled by mere static results. There is no difficulty in getting good statically strong welds. The trouble comes with high intensity alternating stresses in cases where no heat-treatment is possible after welding.

Granting that this point need not arise in the case of shell constructions, it does not follow that welding is necessarily the more economical manufacturing process. Consider, for example, the welded stainless steel Savoia-Marchetti amphibian flying-boat. The pitch of the hull stringers or longitudinals was about 4in. and the thickness of the sheeting was 0.007in. If the formula given at the beginning of these notes is applied for the purpose of comparing the stability of the sheeting between stringers with that of an aluminium alloy panel of the same weight per unit area, but having the longitudinals spaced 8in. apart, it will be found that the panel made from the thicker material will sustain the larger load before buckling, and although spot welding is a much quicker jointing operation than riveting, yet doubling the amount of reinforcement required must be debited against the welding process in the matter of total time taken. A more serious factor than the actual time of welding is the time required for extra jiggling and fitting up prior to welding.

### Welding Duralumin

This is not intended as adverse comment on the Savoia Amphibian, which appeared to be an excellent job both in detail design and workmanship; the criticism is directed simply against the use of steel in stressed skin structures. As to spot or shot welding *monocoque* fuselages, hulls, etc., made from aluminium alloy, it is as yet too early to give an opinion on the subject. There is no doubt that duralumin can be effectively welded on the Sciaky machine. Perhaps at some future Exhibition a light alloy hull or float, so assembled, may be on view; until that time, however, one refrains from comment.

It is, of course, possible that spot welding and riveting will be used jointly; certainly this was done on the Mureaux float. The two processes here had been inextricably mixed up. A first examination showed two rows of large-head rivets closely pitched along some seams, presumably for water tightness, but a close survey showed other seams secured by spot welding. For that and other reasons the *motif* of the combination was not clear.

The technician viewing other people's work naturally examines such constructional or operational features as he is most concerned with in his everyday job. His object is either to learn something new or to satisfy himself that his methods are not out of date; by such means progress is made.

As to sheet-metal structures, the engineer making a start on metal *monocoque* and metal wing work meets at the outset a few problems the answers to which are not always obvious. One such question is: "How large should be the sheets that are actually secured to the framework?" (Only smooth-skinned structures being considered in these notes, it is fairly obvious that high-speed requirements will effectively debar any constructions employing external corrugations.) That question is, however, not difficult to answer; clearly the sheets should be as large as possible consistent with the avoidance of shaping into "three-dimensional" plating.

If working of the sheet material, i.e., thinning by stretching or thickening by compression, can be done in an easy way, there is no reason at all for using narrow stock. In the case of most of the sheet-metal covered exhibits, material of fair width (18in. or more) had, in fact, been used. There were, however, one or two cases in which narrow ribbon had been employed. One such was the fuselage of the Dewoitine D.511, and this construction was evidently adopted as being the most suitable on a small

body of considerable transverse curvature. It is not easy to say, however, why narrow strip was used in preference to sheet on the body of the Amiot 143, which was a large slab-sided structure. If the stresses are relatively high in the skin, then the edges must be close riveted, with consequent considerable increase in cost in the case of strip construction. Moreover, there must in such construction be increase of weight due to overlapped sheets.

### "Developable" Surfaces

Where large area sheets are employed the use of flat or "developable surfaces" is, of course, essential if "stretching" of material is to be avoided, but if a technique exists for the cheap production of non-planar, non-developable metal sheets, then the use of doubly curved surfaces is obviously recommendable. The beautiful appearance of the Avia 534 was due in large measure to the worked surface of the comparatively large sheets used; the curvature could not have been obtained by the use of "laid on" sheeting. Apart from costs, the use of sheeting so curved has everything in its favour. For example, stiffening of the sheets and the elimination of the buckles that are nearly always associated with flat surfaces are two of the advantages that accrue, apart from the ease of obtaining finished structures of curved and handsome appearance. The difficulty lies in the forming process. There is unquestionably a real need in the industry for machinery for the production of such sheets. Panel beating is, of course, out of the question. "Wheeling" is too slow and indecisive, as is the "Swinging Pendulum" method. The use of large pressings, as in the automobile industry, is clearly the answer for quantity production, but one has no intention of venturing an opinion on the question of what amount of production would warrant the manufacture of the tools necessary for the adoption of the process.

### Spacing of Stiffeners

Another difficulty that arises when setting out on this class of work lies in the determination of the best spacing for the skin stiffeners. This can be assessed from the strength viewpoint, but there are many places both on wing and body metal covering where spacing must be based on experience and judgment; and no rules can be formulated as yet. The constructors who place the members too close together put themselves at a disadvantage compared with those who have an eye to riveting costs. The whole matter is bound up with sheet thickness, curvature and the form of stiffening member used. Each constructor must settle the point for himself. As a matter of fact, there was fair uniformity throughout the Show (excepting the case of Mureaux 15R<sup>2</sup>, where the free areas in the wing panelling were very small), which is only to be expected when too much riveting entails excessive costs and too little reduces strength. The inevitable result of the use of thin flat (or nearly flat) sheet and too wide spacing of stiffeners is indifferent appearance and possibly fatigue cracks due to "panting" surfaces. If saving in the number of internal framing members is desired, then advantage should be taken of any curvature given to the skin; reinforcement of a surface having a good deal of curvature is often wasteful in material and cost; the amount of reinforcement should be varied where possible with such curvature.

That there is no object in having a redundancy of internal members was shown in an exhibit on the Bristol Aeroplane Co.'s stand, which demonstrated how the stiffening effect of natural body curvature on the sheet could be utilised so as to render unnecessary the use of a large part of the internal framework normally included in these structures. This exhibit was shown in part in *Flight*, November 22nd, page 1250.

It is hard to understand why exterior stiffeners are used at this stage, such, for example, as were employed on the fuselages of the Bloch 211 BN.4 and the Mureaux 15R<sup>2</sup>,



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particularly the latter, since the Mureaux 180C<sup>2</sup> had a good clean exterior. The use of exterior reinforcements and ridges may be justified on some parts of the wings for ease of assembly, as in the case of the Bloch 211 and the Polish PZL, P24 and the P11C. The confined space of these structures renders assembly something of a problem, but no difficulty necessitating the use of exterior members should arise in the case of a roomy body.

Details of monoplane wing constructions were eagerly sought, and again the Bristol Co. obliged by showing in detail sample specimens of their constructions; as these were described in the Journal of the Royal Aeronautical Society as recently as July, 1934 (page 660 *et seq.*), and by Mr. Langley on page 83 of *The Aircraft Engineer*, November 29, 1934, there is no need to deal with them here except to emphasise one of the chief points in the construction. This relates to the use of high-tensile steel in the spar booms. High stresses may be induced in the flanges of a monoplane spar; thus steel can be used to advantage in these cases. Also, the use of steel strip allows of extensive lamination, and variations of sectional area of spar are thus easily possible with attendant constancy of stress intensity.

This form of wing construction is not put forward as the ultimate solution of the problem of monoplane wing design, but judged by present standards it is a satisfactory answer in respect of wing weight, strength and stiffness. The results already obtained will possibly be improved on

as progress is made with manufacturing technique. More of the skin must be made to be effective to resist thrust without impairing its efficiency against shear forces. The problem has also other aspects. As to interior details of other monoplane wing surfaces, there is little to be said, since the exhibits shown were negligible.

Of the biplanes there is nothing to say at all except to hand the palm, for appearance, to the Letov Co. for their type S231. In this, as in several other biplanes, single truss bracing wires only were used.

While dealing with individual exhibits, mention must be made of the U.S.S.R. stripped aircraft, the Stal 2. The principle used in the design of the fuselage of this aircraft was "large diameter thin-walled tubes in steel." The fabrication of these members by shot welding is a step forward since the writer described structures of this type in this journal in 1928. If a fabric-faired girder is required, then the Russian designer responsible for this aircraft has got the right idea; experience has shown, however, that light alloy *monocoque* bodies are superior to faired girders on most counts.

The Russians are to be congratulated, as also are the Savoia-Marchetti Co., in exposing the interiors of their exhibits to view; in this they are following the established practice of the Bristol and Hawker Companies, and it would be to the advantage of the industry the world over if these examples were more freely followed.

(To be concluded next month.)

## TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH  
COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any bookseller.

FLUID FLOW IN ROUGH PIPES. By A. Fage, A.R.C.Sc. R. & M. No. 1585. (11 pages and 13 diagrams.) October 17, 1933. Price 1s. net.

A body is considered to be hydrodynamically rough when irregularities on its surface affect to a measurable extent the resistance to motion. The effect of roughness on resistance depends not only on the geometrical form of the irregularities but also on the nature of the flow over the surface. In practice, surface roughness does not commonly assume a simple geometrical form, but arises from an indefinite number of irregularities whose size and form cannot be specified with exactness. The resistance of such a surface can only be obtained by measurement. Even when the irregularities have a simple geometrical form, the effect on resistance cannot be predicted theoretically and must be measured.

Experiments are described which show that the resistance of a rough pipe obeying the square law arises from the normal components of the pressures on the irregularities constituting the roughness, and not as in a smooth pipe from surface friction.

Observation with an ultramicroscope shows that the flow in a rough pipe is much more disturbed than that in a smooth pipe. Evidence is obtained of considerable agitation in the flow near the irregularities, and of the creation of eddies comparable in size with the irregularities.

THE STRESSING OF AN AEROPLANE FUSELAGE UNDER COMBINED BENDING AND TORSION. By A. G. Pugsley, M.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1586. (11 pages and 3 diagrams.) June 24, 1933. Price 9d. net.

In designing a fuselage structure it is customary to consider its strength as a freely jointed frame for a number of loading cases, in each of which is contemplated either

(i) an up or down load at the rear end of the fuselage, or

(ii) a side load on the fin and rudder.

For cases of the type (i), owing to symmetry of structure and loading, the forces in the members of a fuselage are usually statically determinate, but for a case of the type (ii) in which a fuselage is subjected to combined bending and torsion, most fuselage structures are highly redundant and some approximate method of stressing becomes desirable for practical use. The present report is concerned with the problem of providing such a method.

The essential structure of a normal fuselage is analysed and the statically indeterminate nature of the external loading system demonstrated. This indeterminacy is then expressed in terms of the distribution of the reactions at the forward end bulkhead of the fuselage, and the factors governing this distribution are discussed.

The proposed revised method has some advantages over the existing method in that—

(i) it provides a mechanism for meeting the main theoretical objection to the existing method by replacing the arbitrary "rigid wall" assumption by distribution factors which can always be chosen to accord with the best available information,

(ii) for most fuselage structures it eliminates the numerical difficulty which sometimes arises when two or more redundancies are involved,

(iii) it is less laborious than the existing method and in view of this and of (ii) above, is more convenient for routine use.

A MODIFIED CHATTOCK GAUGE OF HIGH SENSITIVITY. By V. M. Falkner, B.Sc., A.M.I.Mech., E., of the Aerodynamics Department, N.P.L. R. & M. No. 1589. (7 pages and 2 diagrams.) January 11, 1934. Price 6d. net.

In recent years the necessity for measurement of low speeds and for aerodynamic research at low Reynolds numbers has given rise to a demand for a gauge capable of the accurate measurement of low pressures. The standard Chattock tilting gauge has a limit of accuracy of about 0.000065 inches of water, added to a general error of about 1 part in 1,000. Later experiments have reduced the former figure to about 0.00004 inches of water. The gauge may be converted into a highly sensitive instrument by a simple modification which consists in arranging the liquids so that there is a bubble of the lighter liquid in the heavier liquid (xylene and water). This arrangement differs from all previous ones in that the forces of surface tension and gravity on the bubble are in opposition and the control exerted by the bubble can be reduced to zero. The standard glass-work used with modification to the frame has then a limit of accuracy of 0.0000065 inches of water.

AN EXPERIMENTAL INVESTIGATION OF THE WAKE BEHIND AN ELLIPTIC CYLINDER. By G. J. Richards, Ph.D., A.R.C.Sc., D.I.C. Communicated by Professor L. Bairstow, C.B.E., F.R.S. R. & M. No. 1590. (6 pages and 8 diagrams.) June 28, 1933. Price 9d. net.

The form of the wake behind an elliptic cylinder was examined at a number of values of Reynolds number, and the longitudinal and lateral spacings together with the velocity of the vortices formed were found. The first was found to be constant in any one experiment, whilst the lateral spacing increased with time. The longitudinal spacing and the initial value of the lateral spacing were found to vary with R. The spacing ratio was found to have an initial value of 0.32, whilst it increased exponentially with time, that is down the wake. There also appeared to be a functional relation between the increase of spacing ratio and the velocity of the vortices, the one increasing with the other, and both differing in seemingly similar experiments.

MEASUREMENT OF THE FULL SCALE WATER RESISTANCE OF A III F SEAPLANE IN STEADY AND ACCELERATED MOTION. By E. T. Jones, M.Eng. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1591. (30 pages and 18 diagrams.) December 6, 1933. Price 1s. 9d. net.

The full scale water resistance of a seaplane has been measured to determine how closely the law of corresponding speeds applied to the results of models tested in a tank predicts the full scale resistance. It has been measured directly by means of a special design of undercarriage in steady and in accelerated motion.

The apparatus has proved to be satisfactory and the measurements are reasonably consistent.

The float resistance at speeds between 0.3 and 0.8 of the take-off speed is almost constant and equal to about one-fifth of the displacement at rest. Compared at the same attitude, the full scale resistance is about 10 per cent. higher than that of a 1/10th scale model. The difference of resistance between model and full scale is not necessarily all due to scale and further tank tests are required to show how the resistance of a smooth float increases as rivet heads and other small protuberances, such as lap joints and seams, are added.

The curves of resistance in accelerated motion determined by the direct and indirect methods are in fair agreement. Compared at the same attitude, the resistance in accelerated motion is about 10 per cent. less than the steady motion resistance at all speeds greater than 35ft./sec.

THE FORM OF A HEAVY FLEXIBLE CABLE USED FOR TOWING A HEAVY BODY BELOW AN AEROPLANE. By H. Glauert, F.R.S. Communicated by the Director of Scientific Research, Air Ministry. R. & M.

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No. 1592. (8 pages and 10 diagrams.) February 9, 1934. Price 1s. net.

The mathematical expressions for the form of a heavy cable in a wind have been known for many years, but not systematic numerical results are available. Calculations have been made to derive a family of curves, depending on the weight-drag ratio of the cable, which should suffice to cover all practical problems, involving the towing of a heavy body. The use of the curves is illustrated by a typical numerical example.

THE EFFECT OF WIND ON THE TAKE-OFF OF SEAPLANES. By E. T. Jones, M.Eng. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1593. (14 pages and 16 diagrams. January 12, 1934. Price 1s. net.

Take-off times have been observed on four seaplanes in winds varying from zero to 25 m.p.h. and correction formulae have been deduced from the results. Some results were also obtained from take-offs made down wind. The validity of application of the formula to all seaplanes has been examined and theoretical support to the formula is given. The effect of wind on the maximum weight at which a seaplane can take-off is also examined.

The take-off time and distance in zero wind for all seaplanes can be fairly accurately given by formulae quoted in the paper. The maximum weight at which a modern seaplane fitted with a fixed pitch airscrew can rise from the water is almost independent of the direct effect of wind speed up to the highest wind in which the fully loaded seaplane is capable of being handled on the water.

Gusts and the effect of wind in rippling the surface of the water have not been included in the calculations. The results of practical tests show that there are occasions when a flying boat is unable to rise from a glassy sea but can take-off in a light wind from a lightly disturbed sea.

LANDING AND TAKE-OFF SPEEDS OF AEROPLANES. By R. S. Capon. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1594. (7 pages and 3 diagrams.) January 19, 1934. Price 6d. net.

In landing, the pilot usually stalls the aeroplane when the wheels are at a small distance from the ground. Since the aeroplane is decelerating it follows that in a stalled landing the speed at the moment of contact will usually be less than the stalling speed.

The effect on the landing speed is considered in relation to the height at which the aeroplane is stalled: it is shown that in a typical aeroplane the landing speed will be 0.5 per cent. less than the stalling speed if the wheels are 6in. from the ground at the stall.

The possibility of taking off at speeds below the stalling speed is considered. In the type of take-off where a sudden increase of incidence is made at the end of the run (tail up take-off), a proportion of the weight of the aeroplane is borne by the undercarriage, and in certain types of undercarriage there may be available stored energy to project the aeroplane upwards when the incidence is increased. It is shown that if the whole weight of the aeroplane is borne by the undercarriage just prior to the pull off, the take-off speed may be 13.5 per cent. below the stalling speed (engine-on), or in the more practical case when half the weight of the aeroplane is airborne prior to the pull-off, 8.5 per cent. In many undercarriages, however, there is little available stored energy.

ACCURACY OF PERFORMANCE MEASUREMENT. By J. L. Hutchinson, B.A., and E. Finn, B.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1601. (5 pages and 4 diagrams.) February 7, 1934. Price 6d. net.

A number of flights were made on two aircraft to determine the consistency of repetition tests.

The consistency of measurement of rate of climb was determined from the range of possible mean curves of rate of climb against height which could be deduced according to present practice in routine performance reduction from five climbs of Fox aircraft. This variation amounted to 40 ft./min. at sea level and 90 ft./min. at 15,000 ft.

The consistency of measurement of level speed was determined from five tests of Hart aircraft. The variation between the mean curves was less than 1½ m.p.h. at all heights. The accuracy of speed measurement depends, however, on the stability and controllability of the aircraft, which characteristics in the case of the Hart are very favourable for accurate flying. The above-mentioned accuracy of level speed measurement could not, therefore, be expected with all types.

From a general discussion of the separate sources of error in performance measurement the conclusion is drawn that the actual performance in the test flight is measured accurately and that the largest errors arise in allowing for variations from ideal conditions. Of these variations, vertical currents introduce the most serious errors and it is on this account that a number of tests are necessary.

WIND TUNNEL TESTS ON A BRISTOL FIGHTER MODEL WITH SLOTTED R.A.F.34 SECTION WINGS. By K. W. Clark, B.Sc., D.I.C. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1609. (5 pages and 4 diagrams.) April 14, 1934. Price 6d. net.

Lift coefficient and normal slat forces have been measured in the wind tunnel on a model Bristol Fighter F.2B biplane with slotted R.A.F.34 section wings, for comparison with full scale experiments recorded in Refs. 1 and 2. The model was 1/10 scale and was represented in full detail except for the airscrew and bracing wires. The wings were square tipped and the slats extended over the whole span except for the centre section of the lower plane. The slot chord was 14.5 per cent. of the wing chord.

The maximum lift coefficient of the aeroplane was 0.77 at 27½ degrees incidence compared to 0.84 at 30 degrees full scale. The normal force coefficients on the model reached maxima of 1.81 at 25 degrees incidence for the mid semi-span position, and 1.91 at 30 degrees for the tip position. The coefficients measured full scale were still increasing with incidence at the great incidence tested, with values of 2.35 at 27 degrees incidence for the mid semi-span position and 1.8 at 30 degrees incidence for the tip position.

THE E.M.F. BETWEEN METALS IN SEAWATER. By J. W. Willstrop, B.Sc., A.I.C. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1611. (10 pages and 1 diagram.) June, 1934. Price 9d. net.

If two dissimilar metals immersed in sea-water are connected either by actual contact with each other or by a third conducting material, there will be a flow of current from one metal to the other and this will be accompanied by solution or corrosion of the negative metal. This corrosion is not to be confused with any corrosion the metals might suffer independently as a result of sea-water attack. The tendency for this electrolytic corrosion to occur is dependent on the E.M.F. or potential difference between the metals when immersed in sea-water.

Potentials were measured between various metals and a calomel electrode taken as standard. Actual potential differences between any pair of metals were then obtainable by difference. Most determinations were made at 25°C, but a short series was carried out at 40°C.

Of the metals tested, stainless steel of the 18.8 type and monel metal were the most positive followed in order by brasses and bronzes, "Twoscore" type stainless steels, 13 per cent. chromium stainless steels, duralumin and copper-containing aluminium alloys, ordinary steels, aluminium alloys free from copper, cadmium zinc and finally the magnesium alloy D.T.D.88 which was the most negative of the metals tested. The use of metals of widely different potentials in contact is liable to result in serious corrosion of the more negative metal especially where saline water is likely to be encountered.

WIND TUNNEL TESTS ON A MODEL GLOSTER TROOP CARRIER. WITH AND WITHOUT SLIPSTREAM. By W. G. A. Perring, R.N.C., and C. Callen. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1618. (15 pages and 11 diagrams.) October, 1930. Price 1s. net.

The tests have been carried out to supply data for design purposes.

Without slipstream the maximum lift measured was 0.520 without tailplane and would be 0.524 with tailplane set to trim. The slipstream increased the maximum lift by 0.10 with the tailplane in position. The maximum lift occurred at a model incidence of about 10°, and over the range of speed, 40 to 80 feet per sec. it showed practically no scale effect.

The minimum drag occurred at about 0° incidence, when the drag coefficient was 0.0191 without tailplane and 0.0223 with tailplane at a wind speed of 60 f.p.s. Tested at a wind incidence of 0.6° the drag with tailplane decreased from 0.02419 measured at 40ft. per sec. to 0.02175 measured at 80ft. per sec.

The slipstream increased the effectiveness of the elevator control surfaces, and at a wing incidence of 8.8°, corresponding to a  $k_z$  of 0.3 the moment produced by an angular movement of the elevator was, under full thrust conditions, 35 per cent. greater than the moment produced for the same angular movement of the elevator without slipstream.

The tests without slipstream show that an angular movement of about 12° was sufficient to produce a rudder power of 10 at 10° above the stalling incidence. The slipstream increased by nearly 100 per cent. the moment produced by the rudder, but had practically no effect on the yawing moment due to yaw for zero rudder angle.

COLLECTED REPORTS ON BRITISH HIGH SPEED AIRCRAFT FOR THE 1931 SCHNEIDER TROPHY CONTEST. With an introduction by H. M. Garner, M.A. R. & M. No. 1575. (96 pages and 80 diagrams.) January, 1934. Price 10s. net.

This monograph describes the development of the British aircraft for the Schneider Trophy Contest of 1931, the preparations for the Contest, the actual Contest, and the successful attempts on the speed record after the Contest. The monograph is mainly concerned with the technical aspects, although a tribute is paid to the great skill of the pilots, without which the successes could not have been achieved.

The monograph is divided into sections, each written by the person or persons mainly responsible for the work described, and although the monograph forms a connected whole, the individual reports may be read without reference to the rest of the monograph.

Section I is an introduction by H. M. Garner, giving a brief description of the history of the 1931 Contest and a summary of the contents of the monograph. In Section II the development of the design and construction of the S.6A and S.6B are described by R. J. Mitchell, the chief designer of Supermarine Aviation Co., (Vickers) Limited. Although the design was based on the S.6, the Schneider Trophy winner of 1929, there was a large number of problems which required prompt solution, and these were very ably dealt with by Mr. Mitchell in co-operation with the Air Ministry and National Physical Laboratory staffs. One particularly difficult problem was the provision of adequate water and oil cooling for the engine.

Section III describes the development of the engine by Messrs. Rolls-Royce Ltd. The problem was to extract more power from the engine used in 1929, and although the external shape of the engine was hardly altered, almost the whole of the working parts of the engine had to be redesigned. The airscrews were all of the Fairey-Reed type, designed and constructed by the Fairey Aviation Co., and a brief description of the development of the airscrews with an account of the methods of construction is given in Section IV.

Section V describes the wind tunnel tests, is written by W. L. Cowley, A. McMillan, W. S. Walker and Sylvia W. Skan. It was desirable that models as large as possible should be used, so as to make the scale effect as small as possible. The tests were therefore made on as large models as possible in the Duplex Wind Tunnel at the N.P.L. (size 14 ft. x 7 ft.), the largest wind tunnel constructed at that time in this country.

For the first time in the history of these Contests a large amount of full scale data was collected. This is described by R. K. Cushing, who was the Technical Officer for the High Speed Flight, in Sections 6 and 7 and also in a separate Report (R. & M. 1472). Section 6 discusses the best method of turning, and shows that the best turns are made with a relatively small acceleration. Spectacular turns are of no value. Section 7 is a collection of airscrew performance data. Considering the difficulties of the tests, the standard of accuracy reached was very high, airscrew efficiencies being obtained with a probable error of less than ± 3 per cent. The highest efficiency obtained was 88 per cent., a high value when the high tip speeds are borne in mind. R. & M. 1472 describes the determination of the position errors of the high speed aircraft, a very important piece of work based on the automatic timing apparatus developed by the R.A.E. in 1929. The absolute accuracy of the speed measurements depends finally on this apparatus.

Wing Commander Orlebar summarises the flying experiences of the High Speed Flight in Section 8. The greatest difficulties were encountered in taking off and landing. The take-offs of the S.6A and S.6B fitted with certain airscrews were particularly difficult, because of the large turning tendency.

The medical aspect of high speed flying is discussed in Section 9, by Wing Commander G. S. Marshall. The opinion is advanced that the ordinary Royal Air Force medical examination needs little alteration when applied to high speed pilots.

The monograph concludes with Section 10, giving a short descriptive account of the Schneider Trophy Contest and the two speed-record flights. It is evident that the speed in the Contest could have been improved had not Flight Lieutenant Boothman been instructed to take no risks on the turns and to keep the water temperature of the engine at a safe level by throttling. The speed record of 407½ m.p.h., made on the second attempt by Flight Lieutenant Stainforth was a very good achievement, only made possible by superb piloting.

The monograph illustrates the many aspects of aeronautical research which have to be considered in the development of racing aircraft. Close co-operation between the different specialists was necessary in order to achieve success, and the monograph shows how close this co-operation was in many of the problems.

The large expenditure of time and money, made possible by the generosity of Lady Houston, resulted in the retention of the Schneider Trophy by Great Britain and in a new speed record. The effort was therefore well worth while in its immediate results. The effect of such work in a broader sense, as a stimulant to aeronautical development in general, is almost incalculable.



# THE ROYAL AIR FORCE

Service Notes and News



Air Ministry Announcements

## DESIGNATION OF SQUADRONS AND FLIGHTS

In special cases where, for administrative reasons, it is particularly necessary to describe the function of a bomber squadron more fully, the following abbreviations may be used:—

Function.	Abbreviation.	Type	Example.
Light Bomber ... ..	L.B.	Hart.	
Medium Bomber ... ..	M.B.	Overstrand.	
Heavy Bomber ... ..	H.B.	Heyford.	
General Purpose ... ..	G.P.	Vincent.	

## CRANWELL COLLEGE

The following are extracts from the report of Air Vice-Marshal W. G. S. Mitchell, Commandant of the Royal Air Force College, Cranwell, at the Passing-Out Inspection of Flight Cadets on December 14.

This term saw the inauguration of a course of officers coming from Universities. The syllabus covered by these officers is totally

different from that done by cadets, but their instruction, both in flying and in professional subjects, is superimposed on the normal work of the R.A.F. College instructional staff, who have been supplemented by one officer for that purpose.

The present strength of the College is 109 Flight Cadets, and since the formation of the College, including the term passing-out, 728 Flight Cadets have graduated.

The IV Term Flight Cadets now passing-out are being distributed over all the various different types of squadrons, and as far as possible they have been trained on aircraft similar to those with which the squadrons are equipped. Flight Cadets passing-out have averaged 72 hours on service type aircraft, and 164 hours on all types during the course. The usual courses of instrument flying have been completed with good results.

Motor bicycle accidents continue to occur, but there have been no accidents with four-wheeled motor cars, which appears to justify the policy of allowing these vehicles. Three-wheeled motor vehicles are no longer allowed for Flight Cadets.

## ROYAL AIR FORCE GAZETTE

London Gazette, December 18, 1934

### General Duties Branch

The following Pilot Officers on probation are confirmed in rank:—G. H. Gatheral (Nov. 1); S. G. Birch (Nov. 7).

The following Acting Pilot Officers on probation are confirmed in rank and graded as Pilot Officers (Nov. 7):—C. C. Byar, C. C. Hodder, P. S. Hutchinson, W. O. Jones, V. H. P. Lynham, R. G. Musson, R. G. Slade, J. M. Southwell, W. N. Stubbs.

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation:—C. L. Groom, R. G. Seys (Nov. 7).

F/O. D. W. Smythe is promoted to the rank of Flight Lieutenant (Nov. 22); P/O. A. J. D. Harding is promoted to the rank of Flying Officer (Nov. 1); Wing Com. J. B. Cole-Hamilton is placed on the half-pay list, scale A, from Dec. 5 to 12, inclusive; F/O. T. King is transferred to the Stores Branch on probation (Dec. 3); Flt. Lt. R. E. Meek is placed on the retired list (Dec. 14); F/O. A. R. T. Coke is transferred to the Reserve, class A (Dec. 9); Acting P/O. D. O'C. Byng-Hall relinquishes his short service commission on account of ill-health (Dec. 18); the permanent commission of P/O. W. J. O'Doherty is terminated on cessation of duty (Dec. 13); the short service commission of Acting Pilot Officer on probation M. J. Keating is terminated on cessation of duty (Dec. 19); the notification in the Gazette of Nov. 20, concerning Lt. Com. S. Richardson, R.N., is cancelled.

### Stores Branch

F/O. A. E. Connolly is promoted to the rank of Flight Lieutenant (Dec. 1).

### Accountant Branch

F/O. V. Matveieff is promoted to the rank of Flight Lieutenant (Dec. 3); Sqd. Ldr. E. N. E. Waldron is placed on the retired list on account of ill-health (Dec. 13).

### Medical Branch

Sqd. Ldr. L. P. McCullagh, M.B., B.Ch., is placed on the retired list on account of ill-health (Dec. 15).

### Dental Branch

Flt. Lt. E. Sharp, L.D.S., is transferred to the Reserve, class D (Dec. 14).

### Chaplains Branch

The Rev. J. Black, O.B.E., M.A., is promoted to the relative rank of Group Captain (Dec. 1).

### Legal Branch

Flt. Lt. J. B. Walmsley, D.F.C., is promoted to the rank of Squadron Leader (Nov. 1).

### Commissioned Armament Officer

Flying Officer on probation R. H. Garner is confirmed in rank (Sept. 11).

### Memorandum

The permission granted to Hon. Sec. Lt. J. P. Flanagan to retain his honorary rank is withdrawn on his enlistment into the Royal Army Ordnance Corps (Supplementary Reserve) (Nov. 17).

## ROYAL AIR FORCE RESERVE

### Reserve of Air Force Officers

#### General Duties Branch

A. J. Hagger is granted a commission as Pilot Officer in class AA (Dec. 8); Flt. Lt. W. C. Venmore is transferred from class C to class A (Oct. 10); F/O. C. M. Dransfield is transferred from class AA (ii) to class C (July 26); Flt. Lt. R. S. P. Bobby relinquishes his commission on completion of service and is permitted to retain his rank (Oct. 28); F/O. J. J. W. Nicholson, D.F.C., relinquishes his commission on completion of service and is permitted to retain his rank (Dec. 15); F/O. C. A. Anderson relinquishes his commission on completion of service (Nov. 28); F/O. E. B. W. Bartlett relinquishes his commission on account of ill-health and is permitted to retain his rank (Dec. 7).

## TERRITORIAL ARMY

### Royal Engineers

#### ANTI-AIRCRAFT SEARCHLIGHT BATTALIONS

26TH (LOND.) A.A.S. BN. (L.E.E.).—Sec. Lt. T. Amers to be Lt. (Dec. 19).

## ROYAL AIR FORCE INTELLIGENCE

**Appointments.**—The following appointments in the Royal Air Force are notified:—

### General Duties Branch

**Flight Lieutenant.**—H. A. Purvis, to R.A.F. Base, Gosport, 17.12.34.

**Flying Officer.**—T. A. Jefferson, to Air Armament School, Eastchurch, 11.12.34.

### Medical Branch

**Flight Lieutenant.**—J. S. Carslaw, to No. 5 (Army Co-operation) Squadron, Quetta, India, 25.11.34.

## NAVAL APPOINTMENTS

The following appointments were made by the Admiralty:—Lt. Com. (Flt. Lt., R.A.F.).—J. B. HEATH, to *Drake* (Jan. 1). Lts. (F/O., R.A.F.).—H. J. F. LANE, to *Drake* (Jan. 1); and I. C. ROWE, to *Furious* (undated).

Lt. (F/O., R.A.F.).—J. C. H. PRICE, to *Victory* (Dec. 14); and to *Courageous* (undated).

### Promotions

Lt. J. E. FENTON (Flt. Lt., R.A.F.) to rank of Lt. Com. (seny. Dec. 15).

# COMMERCIAL AVIATION

## — AIRLINES — AIRPORTS —

### CROYDON

*A "Car" by Air : Special K.L.M. Trips : Aviation Old-timers : Sixty-one Tons of Freight Last Week*

**D**URING last week journalistic circles thrilled to the news of a car being transported to Paris by air. The story was true, and if you only read the Press accounts of the matter you probably have visions of a large Rolls-Royce being driven up an inclined plane into an Air France machine, or of a motor coach being slung aboard *Scylla* with a crane.

What actually happened was that a single-cylinder Rytcraft "Scoota Car" was ordered by a Paris fountain pen firm by 'phone. There was just time to rush it down to Croydon in time for the Imperial 12.30 departure, and it was in Paris by 2.30 p.m. I will not spoil the story by saying that a powerful traffic hand lifted the motor car into the aeroplane, as I did not see the loading.

The mysterious Mr. Fokker, as he has recently become, left Croydon by K.L.M. during the week. News-hounds insist that Mr. Fokker is building a huge factory in this country, but he, like Brer Rabbit, "lays low and says nothing."

Olley Air Service recently carried a difficult stretcher case from Vichy to London in very bad weather. The patient had serious spinal trouble. The flight was successfully accomplished, and doctors afterwards reported that the patient slept more comfortably and for longer periods after the journey than before it. This company also made a rush taxi journey one day during the week, when Michael Beary, the jockey, had to be in Paris in a hurry early in the morning.

On Wednesday the ill-fated Douglas, piloted by Beekman and Steenbergen, set off with special Christmas mail from Amsterdam to Batavia. Beekman held the Batavia-Amsterdam record of seven days with the old "Titan"-motored Fokker F7b until Smirnoff reduced the time last Christmas, with an F12, to four days and some odd minutes. Hondong, another K.L.M. pilot well known on the London route, is at the moment of writing well on his way to Dutch Guiana with Christmas mails. [The machine arrived at Paramaribo on Monday.—Ed.]

Smirnoff has completed nearly 13 years with K.L.M. He was one of the earliest civil pilots in Europe, and I remember him flying for the original Belgian Company, S.N.E.T.A., which started with D.H.9 machines. He was in the Imperial Russian Air Force during the War.

Mr. F. G. Hewlett, of the Anglo-American Oil Co., is another old stager, with service at Cricklewood and Hounslow to his credit. He was one of the first in the field at Croydon. His many friends will be delighted to hear that he has been appointed aviation circuit manager, a position his business ability and genial disposition admirably qualify him to fill.

About sixty-one tons of freight passed through the airport of London last week, and it is instructive to note that only sixteen of these were imported, the remainder being outward goods.

A. VIATOR.

### A German Far-Eastern Flight

The Junkers Ju 52 (three 650 h.p. B.M.W. "Hornets"), which was flown out to Shanghai by D.L.H. in 8 days 6 hr 20 min., was due to start its return flight to Berlin this week. The route was *via* Hanoi, Rangoon, Calcutta, Jodhpur, Karachi, Jask, Baghdad and Cairo.

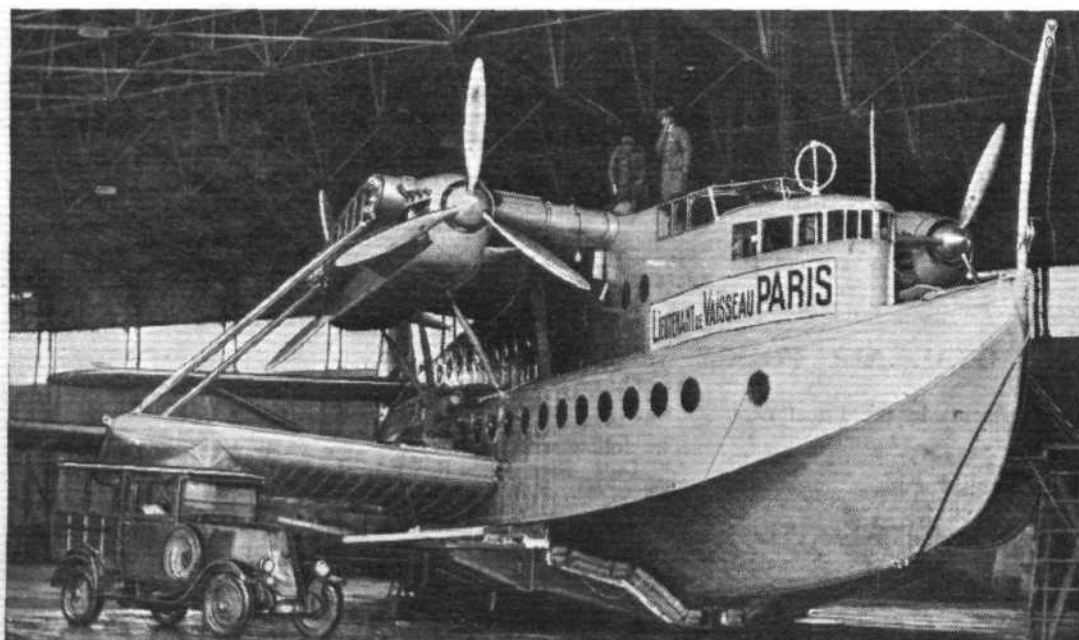
### Pan American Airways Forge Ahead

A Sikorsky S.42 is being equipped as a "training ship" for long-range ocean flights. Tankage to give the boat a comfortable range of 3,000 miles is being arranged, with a special high-speed pumping system and flow-meter equipment. Two-way wireless and a new D/F device will be fitted.

Initial long-distance flights will be made over known routes, and the first will be from Bridgeport (Conn.) to Miami. Later on it is likely that the boat will be taken over to the Pacific Coast.

Pan American Airways have already a firm position in the Orient, with nearly half the holding in China National Aviation Corporation, and plans are well under way for an experimental trans-Pacific flight from the Pacific Coast to the Philippines and China.

Incidentally, the S.42 *Brazilian Clipper* has been placed temporarily on the Caribbean service between Miami and San Juan; the S.42 reduces the trip to a one-day affair.



**NEARING COMPLETION:** The giant Latécoère boat *Lieutenant de Vaisseau Paris*, designed for the South Atlantic crossing, in course of erection at Biscarosse. A maximum speed of 155 m.p.h. and a useful range of about 2,800 miles are expected. The engines are Hispanos and the maximum permissible all-up weight will be 81,570 lb. with an actual payload of 26,000 lb.



## HESTON

### *A D.H.89 for Persia : An Aid to Blind Take-offs*

A NEW D.H.89 left Heston on the morning of December 19 for operation by Airwork, Ltd., in Persia, on behalf of the Anglo-Persian Oil Co. Mr. J. J. Parkes, Technical Manager of Airwork, is flying it out, and Lyons is to be their first halt. Among the passengers is Mrs. Parkes. Prince Omar Halim, a flying pupil of Airwork's associated Egyptian company, hopes to leave Heston before Christmas on a flight to Egypt. He has purchased a Miles "Hawk Major," and he is looking forward to the pleasure of out-distancing Egypt's other civil aeroplanes.

Heston has installed a simple aid to those machines whose blind-flying instruments do not register until the aeroplane has attained flying speed. To assist the pilot in a fog take-off, a white dotted line has been painted across the aerodrome on a compass bearing of 85 deg., or almost exactly East and West.

### *The K.L.M. Tragedy*

After being missing for nearly twenty-four hours, the burnt-out wreckage of the K.L.M. Douglas, which was carrying the Christmas mail to Batavia, was found ten miles south of Rutbah Wells. There were three passengers and a crew of four on board. At the time of the accident the weather was so very bad that neither Imperial Airways nor the R.A.F. were flying. The commander, Beckman, had had a long experience over the route.

Too much praise cannot be given to the Air Ministry and the R.A.F., who placed everything at the disposal of K.L.M., and the wreck was located by Number 14 Bomber Squadron stationed at Amman, whence surgeons were carried to the scene. The Company's superintendent flew over in an Imperial Airways machine.

Meanwhile, in Europe, Geysendorffer and Sillevus left for Amman in an F.12 with Netherlands Air Ministry and technical officials on board. Certainly K.L.M. intend to do everything possible to clear up the cause of this tragedy.

### *Duplication of Empire Services*

Air mail users are reminded that, as stated in *Flight* of November 29, the services from London to Johannesburg will, from Sunday, December 30, depart on each Sunday and Wednesday; those to Calcutta leave on Tuesdays and Saturdays, the first leaving on January 1.

### *Aviation and Commerce*

As a result of the deputation from the London Chamber of Commerce, the Association of British Chambers of Commerce and the Federation of British Industries, which was received last June by the Postmaster-General, a committee, on which all three bodies are represented, has just been formed, and held its first meeting on Wednesday of last week.

It is to be known as the Commercial Aviation Committee, and will be composed of four representatives from each body.

The chairmanship is to be an annual appointment to be held in turn by a representative of each body. The first chairman is Sir Stephen Demetriadi, President of the London Chamber of Commerce, and the secretary is Mr. S. Henderson, The London Chamber of Commerce, 69-73, Cannon Street, E.C.4.

At the annual meeting of the Civil Aviation Section of the London Chamber of Commerce on December 5, Mr. Ivor McClure was elected chairman of the section for the year 1934-35 in succession to Major H. Hemming, A.F.C., whilst the Viscount Ratendone and Mr. Nigel Norman were appointed deputy chairmen.

### *Tata Air Mail Service*

The Tata air mail service has, during the second year of operations, achieved 100 per cent. regularity; the service did not miss a single connection with Imperial Airways. During the year 16.57 tons of mail were carried, as compared with the 10.48 tons carried last year.

Although the service is for mail, passengers are carried on request, and during the past year a number of persons travelled by the line. There is an increasing demand, says the Company's report, for passages from Bombay to Karachi, but owing to very heavy mail loads in this particular direction they have been unable to offer accommodation to many prospective passengers. However, in the not distant future, they hope to re-equip the service with bigger machines, when it will

This line is bisected by a double cross-line twenty feet long, and a single white cross-line marks each quarter of the total distance of 805 yards. If there is sufficient visibility to watch the ground at all, the pilot can check his direction and the distance he has travelled on the aerodrome by watching this line as he takes off parallel to it.

Ten cubic yards of chalk were used in making the line, and the method adopted, after a preliminary theodolite survey, was for two parties to start excavating at opposite ends of the aerodrome. Their ancestors must have been ploughmen, for they were only 1½ inches out when they met in the middle.

Viscount Furness has purchased, from Brian Lewis and Co., Ltd., a luxuriously fitted D.H.89 to replace the D.H. "Dragon" which he previously owned and which is now on charter to Mr. Whitney Straight, the racing motorist.

be possible for Tatas to develop a regular passenger service between Karachi and Bombay.

Uninterrupted regularity is all the more praiseworthy, considering the bad weather conditions during the monsoon, the lack of wireless facilities and of emergency landing grounds, and the modest organisation and equipment with which the service is equipped.

### *New Alaskan Service*

Early next year a 675-mile experimental extension will be made in Pacific Alaska Airways routes. A trial service will be flown from Fairbanks to Whitehorse and Juneau, where a connection will be made with the Alaska Steamship Company. Lockheed "Electras" will probably be used.

### *Provincial Airways' New Venture*

As foreshadowed in the Croydon news of December 6, Provincial Airways propose to inaugurate, on March 1, a service between Hull, Nottingham, Leicester, Southampton, and the Isle of Wight, leaving Hull daily at 8.30 a.m. and the I.O.W. at 5 p.m. The company hopes to carry mails on this route.

### *Hillman's Airways, Ltd.*

The prospectus of Hillman's Airways, Ltd., the new company to which we referred the other week, was issued on December 18. As previously stated, this company has been formed to acquire the business of Edward Henry Hillman, Ltd. (formerly Hillman's Airways, Ltd.), with a capital of £150,000 in 600,000 Ordinary shares of 5s. each, the vendor company receiving as the whole of their purchase consideration 120,000 fully-paid shares. Besides maintaining and improving the existing operations of the original company, the following developments and extensions are contemplated: New services between Essex Airport, Ostend and Brussels, Essex Airport and Dieppe; and Essex Airport and Cherbourg; increased services to Paris; development of the freight-carrying and charter sides of the business.

### *Graf Zeppelin's 621,370 Miles*

On her return to Friedrichshafen the *Graf Zeppelin* achieved her millionth kilometre. Eighteen members of the crew have flown with her over this distance during six years of operation.

According to the statistics of the Hamburg-America Line, who manage the passenger and freight business for the Luftschiffbau Zeppelin, 423 flights were carried out, of which about 90 were crossings over the ocean. The airship was in the air for 9,815 hours, carried 27,700 passengers, over 5½ million letters, and 92,594 lb. of cargo, without a single mishap. The original 72 hours scheduled for the Friedrichshafen to Pernambuco run was often considerably reduced.

The growing confidence in airship travel is shown by the increase in passengers carried. During 1932 only four paying passengers were carried on an average per flight; during 1933 this was increased to nine passengers, but this year the available accommodation for twenty passengers proved to be insufficient on most of her voyages. The fares have also been considerably reduced.

Flights to South America will probably be resumed at the end of March, 1933, and the new airship, L.Z.129, will probably make a few trips to North America during the late summer. The flights across the North Atlantic will take about two-and-a-half days, and the fares will be from £80 to £90.

## Commercial Aviation

### Wireless at Kimberley

The wireless station at Kimberley, in South Africa, should be completed before the end of this year. This station will, of course, be equipped with D/F apparatus. Meanwhile, the new direction finder at Bahrien has been successfully tested.

### New Services in Soviet Russia

New air lines between Archangel and Onega, between Archangel Ust-Tsilma and Naryanmar, and between Archangel and Skytvikar are to be put into operation at the end of this month.

The largest northern air line of the Soviet Civil Air Fleet—from Irkutsk to Yakutsk (1,680 miles) will be re-opened.

### For Trans-Saharan Travellers

No praise could be too high for the assistance given by the Shell concern to pilots flying or wishing to fly in the Near East. The Algerian branch of Shell has produced a handbook, "Guide de Tourisme Automobile et Aérien au Sahara," intended for the use of travellers proposing to cross the Sahara either by car or air, which should prove a veritable *vade-mecum* for those fortunate enough to travel in those parts.

### Control of Irish Free State Aviation

It is learned in Dublin that consideration is being given by the Irish Free State Government to the unification of the control of aviation in that country. At present the Minister for Defence, through a Director of Military Aviation, controls the activities of the Army Air Corps. Civil aviation is governed by the Ministry for Industry and Commerce through its Transport and Marine Branch. The Army Air Corps provides examiners for candidates for licences and technical advisers to the Department of Industry and Commerce. It is considered that this method of control is cumbersome and a return to the system by which an Air Council is the governing authority is suggested. In the early days of the Free State an Air Council was formed but it lapsed during the Civil War of 1923.

### By Air to Kashmir

Indian National Airways' Avro Ten machine recently made a survey flight from Delhi to Srinagar, in Kashmir. It is likely that the survey will lead to the establishment of a regular air service between Srinagar (Kashmir) and Lahore (Punjab).

### Record Mail from India

The largest westbound mail (4,150 lb.) ever dispatched left Karachi last Wednesday in three machines, an H.P. 42 and two Armstrong "Atalantas."

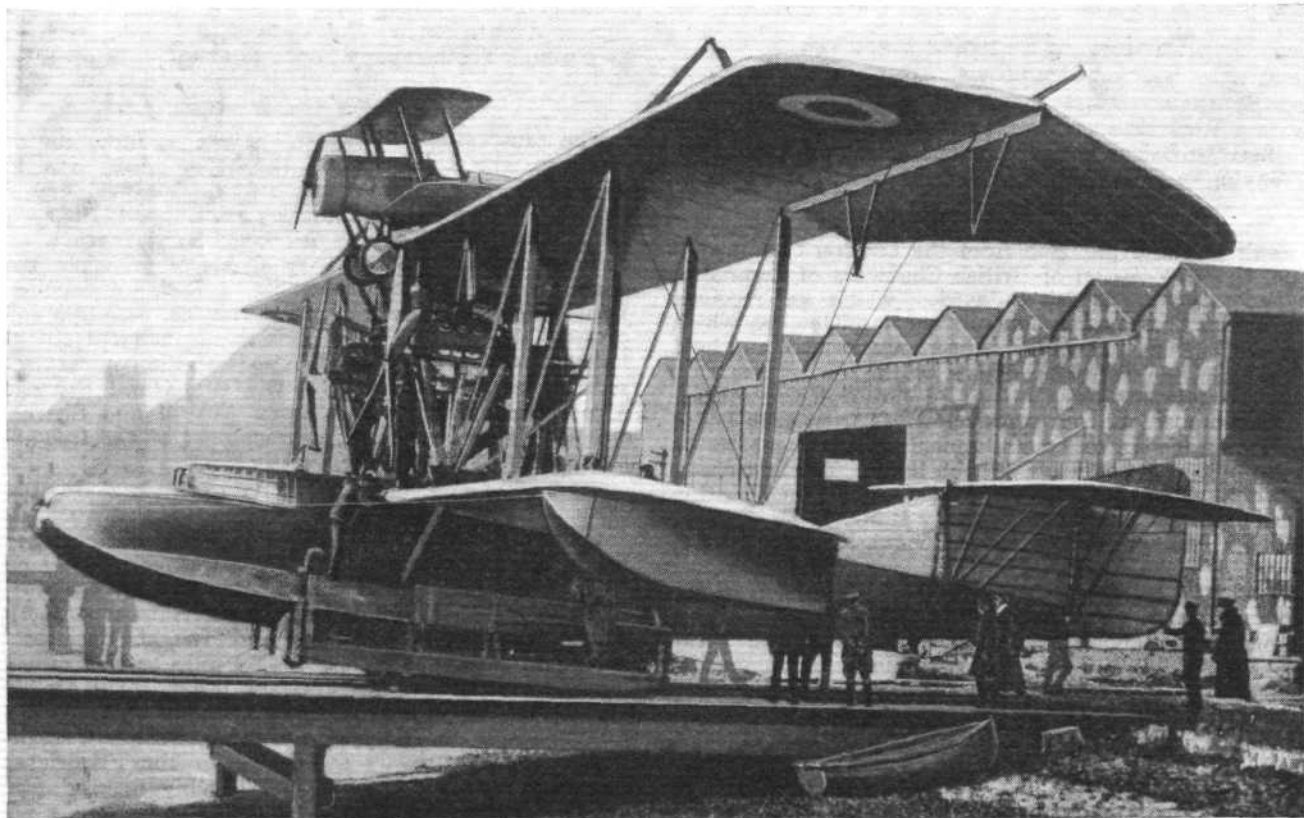
### Malayan Aerodrome Improvements

Metalled runways, 800 yards long and 150 yards wide, are to be laid down at Penang aerodrome since the Legislative Council has voted a considerable sum for its improvement. The aerodrome at Alor Star has a much harder surface, and this will be merely drained.

### Propaganda in Portugal

The French participation in the two flying meetings at Amadora on November 4 and at Oporto on November 11, inspired the Germans to send two modern aircraft to Portugal—a Junkers Ju.52 and a Heinkel 70. Originally, these two aircraft were to have taken part in the Amadora display of November 4, but they did not do so on the grounds that "they were not aerobatic aircraft."

They arrived in Lisbon on November 11, being suitably received by representatives of the German Legation, the Lisbon Nazi Group, and Portuguese authorities. The purpose of the visit was ostensibly to render homage to the late Capt. Abreu, to which purpose the two machines flew over the cemetery where Capt. Abreu's remains are buried, after which they showed themselves off to the natives.



**ANTECEDENT:** In our recent description of the Short-Mayo "composite aeroplane" scheme we referred to a War-time experiment on the same lines, carried out at Felixstowe. This photograph, reproduced from *The Wing* (journal of the Felixstowe R.A.F. Station) of November, 1918, shows the machines concerned; the parent aircraft was the original Porte "Baby" flying boat and it carried a Bristol "Bullet." The late Lt.-Col. Porte (in white muffler) is seen walking under the tail plane; the pilot of the "Bullet" was the late Flt. Lt. Day. The copy of *The Wing* from which this was taken was kindly sent by Mr. Charles A. Rippon, who is Hon. Chairman of the Northern Heights M.F.C. and a member of the Felixstowe Old Comrades Association.



## MODELS

### *An Original yet Realistic Cabin Biplane Powered with the "Atom Minor" Petrol Engine*

#### THE SPENCER "ORION" CABIN BIPLANE

THAT the great advance made by modern model aircraft is not confined to rubber-driven models is indicated in the latest petrol-driven model designed by Mr. R. P. Spencer, of Newcastle-on-Tyne, a brief description of which we are able to give this week. The chief aim in evolving the design for this power-driven model—the "Orion" cabin biplane—was to obtain good protection for the propeller and engine, and at the same time produce a model which would have both realistic and graceful lines.

The "Orion" was designed primarily for use with the A. E. Jones "Atom Minor" engine, and as a compliment to the manufacturers of this power unit it was the designer's resolve that the ultimate result should be a model which, if possible, would set a higher standard in the design of power-driven model aircraft. Here are a few of the "Orion's" outstanding features.

The wings are attached to the main centre section rib and wing roots on the fuselage by special fittings which allow them completely to detach themselves in the event of a crash; the interplane struts, of course, also come away, likewise the tailplane. The undercarriage is of the sprung type, the struts, radius rods, and interplane struts are all made of "Duralumin" tube, with fork ends, etc., made of the same material; these in turn are attached to steel plates on the fuselage by steel bolts.

The front skid operates an ignition switch to cut the engine on landing, and will also have this effect if the tail rises too high when taking off—an important feature which should reduce disastrous "false starts." The batteries and ignition coil are fitted as a unit into the detachable nose of the fuselage, and are free to slide out in the event of a heavy landing. This detachable nose is purposely very lightly made so that it can entirely collapse on striking any object and thus absorb the greater part of the shock. A rubber or other resilient nose piece can be fitted for those who prefer it.

In addition to the variable tailplane incidence adjustment, the propeller thrust line can easily be varied by tilting the complete engine on its special mounting plates. The rudder control wires are brought to a variable locking device between the rear centre section struts and outside the fuselage, while the

automatic engine throttle control mechanism to predetermine the time of flight for short flights is also placed outside the fuselage at this point. For longer flights the time is controlled by the quantity of fuel in the petrol tank.

As regards materials used in the construction of the "Orion," the main longerons of the fuselage are of birch with intermediate stringers of balsa. The main transverse frames under the centre section are of plywood, while other frames are mostly of balsa. Fin spars and rudder post are of birch with balsa ribs. The forepart of the fuselage and the complete top and bottom through to the rudder post is covered with thin balsa, again externally covered with doped Jap tissue or silk.

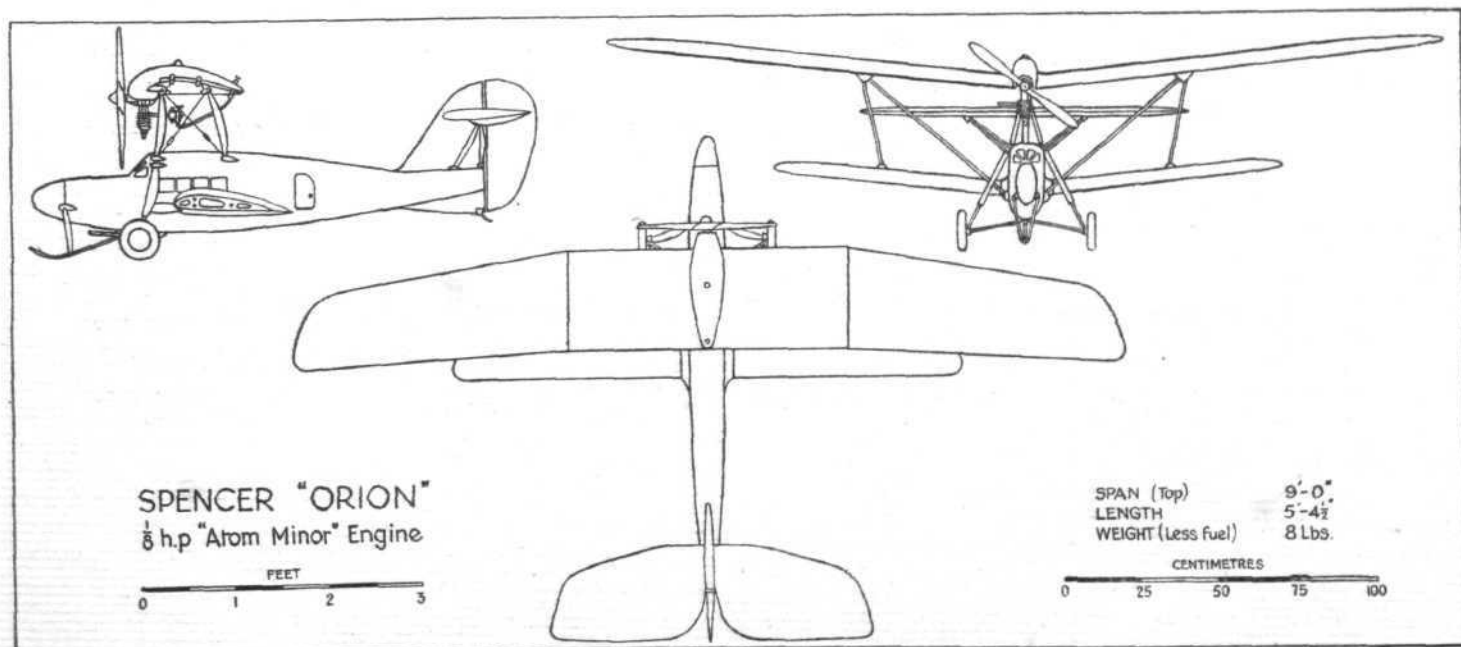
The top wing main centre section rib is built up from plywood fitted with steel plates where the centre section struts and engine plates are fitted, and the lower wing fillets on either side of the fuselage are built up from balsa, with short balsa spars running through from side to side of the fuselage.

Steel plates are fitted to the fuselage frames, where all struts, etc., are attached. All undercarriage and centre section struts are duralumin faired off with balsa, covered with doped silk, but the lift and drag struts are built up from birch and balsa; interplane and tailplane struts are of balsa.

Front and rear spars of the top and bottom wings have



Three-quarter front view of the Spencer "Orion" biplane. It has a span of 9 feet and is equipped with the A. E. Jones "Atom Minor" engine.



General arrangement drawings, to scale, of the Spencer "Orion" cabin biplane.



How the ignition coil and battery unit is housed in the detachable nose of the Spencer "Orion."

birch flanges with balsa webs—or the spars can be made completely of balsa. All ribs, internal bracing, and the leading edge are of balsa, while the trailing edge is of birch. The wings, from the leading edge to the front spar, are covered with thin balsa, and the entire machine is covered with Jap silk, doped.

The principal characteristics of the "Orion" are: Span (top) 9ft., (bottom) 5ft. 6in. Maximum chord, 12.5in. Overall length, 5ft. 4.5in. Span of tailplane, 3ft. 6in. Maximum chord of tailplane, 12in. Weight of complete machine, excluding fuel, 8 lb.

An elaborate set of full-size working drawings has been prepared, and sets of prints may be obtained from A. E. Jones, Ltd., 97, New Oxford Street, London, W.C.1.

*This section, devoted to the progress and development of Model Aeronautics, is published in FLIGHT each month.*

## THE INDUSTRY

### A SIMMONDS MOVE

ON account of the continuing large demand for their aerocessories both in the United Kingdom and abroad, Simmonds Aerocessories, Ltd., have removed their head office to new and enlarged premises at Shell-Mex House, Strand, London, W.C.2.

The head office staff will in future comprise not only the commercial and technical direction, but also an approved inspection department and a dispatch department for all aerocessories except the Simmonds-Corsey Controls, which will continue to be dispatched from the Birmingham works. The new telephone number is Temple Bar 2373, and the telegraphic address Aerocessim, Rand, London.

### DUCKHAM'S OIL IN PARIS

Alexander Duckham and Co., Ltd., of 16, Cannon Street, London, E.C.4, state that supplies of their N.P.5 aero oil are now available at Le Bourget Aerodrome, being held in stock by the Société Pour Le Developpement de l'Aviation, whose offices abut No. 6 hangar.

### TWO VACUUM RETIREMENTS

Mr. Alfred Marsden, one of the Glasgow representatives of the Vacuum Oil Company, who joined the company three years after it was established, has just retired after over forty-five years' service.

Mr. J. M. Armel, manager of the company's Birkenhead works, has also retired, after twenty-eight years' service in that capacity.

### CHANGE OF ADDRESS

From now on, the address of Pobjoy Airmotors, Ltd., will be Rochester, Kent, instead of Hooton, Wirral, Cheshire. The new telephone number is Chatham 3500, and the telegraphic address "Pobjoy, Rochester."

### ENGLAND-AUSTRALIA AIR RACE FUEL SERVICE

Speaking at the official Banquet on December 19, Mr. Scott, co-winner with Mr. T. Campbell Black of the Australia Air Race, said that their success was largely due to the admirable organisation of the petrol and oil companies which supplied their wants with the minimum of delay. In this connection it is interesting to note that all three of the "Comets" used Stanavo fuel and Wakefield's oil.

### "INCIDENTALS" ON THE VICEROY'S AVRO

Marconi combined medium- and short-wave transmitting and receiving apparatus, with a "homing" device, is fitted to the new Avro 642 supplied to the Viceroy of India. The installation is contained in a small compartment behind the pilot's cockpit. Both telephone and telegraph communication are available with the transmitter and receiver, type A.D.37/38, on the dual wavelength ranges of 40-80 and 500-1,000 metres. An outstanding feature of the machine is the comfortable cabin upholstered by L. A. Rumbold and Co. The four Siddeley "Lynx" IVc engines are lubricated with Speedolene oil, manufactured by Silvertown Lubricants.



### NEW COMPANIES

EDINBURGH FLYING CLUB LTD., registered in Edinburgh December 10, as a company limited by guarantee, without share capital. Objects: to provide the means for instruction and education in aviation and all matters pertaining thereto. The first directors are:—Thomas J. C. Gifford, 3, Glenfinlas Street, Edinburgh, W.S. Charles J. Dalrymple Shaw, 17, Hope Street, Edinburgh, Advocate. Ernest H. Stevens, Hermand, West Calder, law student. James L. Jack, 2, Kew Terrace, Edinburgh, bank agent. And 11 others. Secretary: David F. McCurrach. Registered office: 3, Glenfinlas Street, Edinburgh.

HILLMAN'S AIRWAYS LIMITED, Essex Airport, Stapleford, Essex, was registered as a "public" company on December 12, with a nominal capital of £150,000 in 600,000 shares of 5s. each. The objects are to establish, maintain and work lines of aerial conveyances between the Essex Airport, Stapleford, Essex, and all other parts of the world and to carry on the business of aerodrome and air transport service proprietors, etc. The first directors are:—Edward Henry Hillman (chairman and managing director), Gifford Lodge, Hare Street, Gidea Park, Essex (director of Edward Hillman's Saloon Coaches, Ltd.). Edgar L. Granville, 5, Catherine Street, S.W.1. (director of Langley (London) Ltd.). Sir Charles A. Harris, Greenhill Brow, Farnham, Surrey (director of Cotton Plantations, Ltd.). Edward A. J. Hillman, Gifford Lodge, Hare Street, Gidea Park, Essex. Secretary: G. W. Bennett. Solicitors: Daybells, 4, Crown Office Row, Temple, E.C.4.

TECALEMIT LIMITED was registered as a "public" company on December 12, with a nominal capital of £400,000 in 5s. shares. The objects are to enter into an agreement for the acquisition of the whole of the undertaking, property and assets of Tecalemit, Ltd., subject to its liabilities. The following persons have consented to be directors:—Emile Piquerez, 4, Rue de la Pommerai, St. Cloud, France, Administrateur-Delegue Societe Anonyme Tecalemit. Edward F. Briggs, Walnut Tree Cottage, Cookham, Berks, Group Capt., R.A.F. Robert A. Chalmers, Aldbar, Brechin, engineer. Sylvester G. Gates, 77, Eaton Place, S.W.1 (director of W. H. Botsford and Co., Ltd.). Albert E. Leonard, 25, Portland Place, W.1. (chairman of London and West End Property Development Corporation Ltd.). Joseph Christe, 24, Rue Paul Bert, Suresnes, France, (directeur Societe Anonyme Tecalemit). Solicitors: Slaughter and May, 18, Austin Friars, E.C.2.



### PUBLICATIONS RECEIVED

*Aeronautical Research Committee Reports and Memoranda*. No. 1614. Abstract. Statistical Measurements of Turbulence in the Flow of Air through a Pipe. By H. C. H. Townend. June, 1933. Price 2d. net.

*Aeronautical Research Committee Reports and Memoranda*. No. 1616. Buckling of a Linked Beam Having Strength in Flexure and Shear. By R. A. Fairthorne. January, 1934. Price 6d. net. London: H.M. Stationery Office, W.C.2.

*Aeronautical Research Committee Reports and Memoranda*. No. 1609. Wind Tunnel Tests on Bristol Fighter Model with Slotted R.A.F. 34 Section Wings. By K. W. Clark. April, 1934. Price 6d. net.

*Aeronautical Research Committee Reports and Memoranda*. No. 1617. Stiffness Determination in Certain Cantilever Wings. By H. Roxbee Cox, J. Hanson and W. T. Sandford. May, 1934. Price 1/- net.



### AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: Cyl. = cylinder; i.c. = internal combustion; m = motors. (The numbers in parentheses are those under which the Specification will be printed and abridged, etc.)

#### APPLIED FOR IN 1933

Published December 27, 1934.

- 5415. WALKER, G. E. Aircraft. (420,146).
- 16987. STIEGER, H. J. Multi-engined aeroplanes. (420,313).
- 20181. A.T.S. Co., LTD., and FOLLAND, H. P. Aeroplane wings and like structures (420,184).
- 22105. LA CIERVA, J. DE. Aircraft with freely rotative wings. (420,322).
- 29909. FAIRLEY AVIATION Co., LTD., and LYON, G. Evaporative cooling systems for aircraft engines. (420,331).
- 34812. FAIRLEY AVIATION Co., LTD. and FORSYTH, A. G. Cooling dynamo-electric machines on aircraft. (420,260).

#### APPLIED FOR IN 1934

- 8994. WALKER, G. E. Aeroplanes with folding wings. (420,209).
- 29446. CHAPMAN, E. Pontoon for seaplanes. (420,291).